

**REMEDIAL DESIGN
INVESTIGATIVE ACTIVITIES
SUMMARY REPORT
(REVISION 1.0)**

VOLUME I

Prepared for

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Representing

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2.0 PROJECT BACKGROUND

1. This chapter provides a summary of historical site investigations that have been performed from 1971 through 1995 for various investigative purposes as described in Chapter 1.0. In addition, a review of historical aerial photographs has been performed and is summarized in Table 2.1. Copies of the aerial photographs are provided in Appendix I.
2. Additional RD Investigative Activities, as specified in the Amended SOW (EPA, 1997b), have been conducted at the Site by EPA and WDIG from 1997 to 1999 and are further discussed in Chapters 3.0 and 4.0.

2.1 SUMMARY OF PRIOR SITE INVESTIGATIONS (1971 TO 1987)

1. Several investigative activities have been performed at the Site from 1971 to 1995 as mentioned in Section 1.3. The following sections, including Table 2.2, summarize the scope of work and findings for each of these investigations. Note that this information has previously been submitted and was taken from the 1998 EPA RI report.

2.1.1 ADVANCED FOUNDATION ENGINEERING, INC. (AFE), 1971

1. In 1971, AFE conducted a Preliminary Foundation Investigation for a proposed industrial building to be located at 12707 East Los Nietos Road, southwest of the reservoir near Los Nietos Road. Results of the geotechnical investigation found this area to be underlain by fill material (0 to 3 feet), clayey silt and silty clay (3 to 15 feet) and sandy soil (15 to 20 feet). No evidence of contamination was observed during the investigation.

2.1.2 HAMMOND SOILS ENGINEERING (HSE), 1975

1. In 1975, HSE conducted a Fill Investigation and Preliminary Soils Study of the same parcel (12707 East Los Nietos Road) for Coastal Developers Company. The scope of work included a total of four backhoe investigations in the proposed building area to depths ranging from 7 to 11 feet.
2. According to this field investigation, fill material was located over approximately two-thirds of the site. The fill was described as mottled sandy silt and clay with some deleterious material and oil contaminated soil (HSE, 1975) and was found to a depth of approximately 7.5 feet at

the extreme north of the area, 8.5 feet in the center and 15 feet in the south. HSE determined that the fill was underlain by firm to hard, moist, reddish brown, clayey silt or silty clay to a depth of 10 feet.

2.1.3 MOORE & TABOR, 1981

1. Moore & Tabor conducted a Foundation Investigation in 1981 for a proposed commercial/industrial park to be located on approximately 4.8 acres of land at the northeast corner of Greenleaf Avenue and Los Nietos Road for Castille Builders, Ltd. Results of this investigation indicate that loose fill, approximately 1 to 5 feet deep, covers the majority of this site. This fill is described as silty sand and clayey silt with intermixed trash and debris. Alluvial deposits underlying the fill are described as interbedded, moderately dense to dense, fine to medium silty sand, and soft to very soft clayey and sandy silt. These deposits were observed at depths extending to 16 feet.

2.1.4 DAMES & MOORE, 1984

1. Dames & Moore completed four borings as part of a Phase I Remedial Investigation of the subsurface conditions at the Site in September 1984. This investigation was conducted for the Redevelopment Agency of the City of Santa Fe Springs. The purpose of this investigation was to provide a generalized vertical profile of the chemical characteristics of the reservoir and areas outside the reservoir. One boring was drilled in the center of the concrete reservoir and was terminated at a depth of 22.5 feet. The remaining 3 borings were drilled around the outside perimeter of the reservoir boundary and were terminated at depths which range from 18.5 to 23.5 feet. Refer to Figure 2.1 for the locations of the borings.
2. Soil samples were collected every 2.5 feet for logging purposes and chemical analysis. Concentrations of organic vapors were measured using a portable HNu photoionization detector (PID) to determine which samples should undergo laboratory analysis. Selected samples were analyzed for California Assessment Manual (CAM) metals and EPA priority pollutant organics (Methods 8240 and 8270).
3. Boring logs indicate that approximately 4 to 9 feet of fill material was encountered. Native soil, composed of clay with silt and sand, was observed at a depth of 23.5 feet in the borings outside the reservoir.

4. Analytical results provided in the Summary of Findings Report (Dames & Moore, 1984) indicate that one of the soil borings, DMEB-1, contained levels of barium (310 ppm), cadmium (2.6 ppm), copper (57 ppm), lead (250 ppm), nickel (38 ppm), vanadium (45 ppm) and zinc (2,300 ppm). DMEB-2 (composite) contained concentrations of barium (930 ppm), cadmium (1.9 ppm), copper (28 ppb), lead (280 ppm), and nickel (27 ppm). DMEB-2 had similar concentrations as DMEB-1 including mercury (0.22 ppm) and thallium (50 ppm). However, vanadium and zinc were not detected. DMEB-3 contained only concentrations of cadmium (1.6 ppm) and vanadium (32 ppm). DMEB-4 (5-foot sample) contained concentrations of barium (320 ppm), cadmium (1.9 ppm), copper (34 ppm), lead (17 ppm), nickel (23 ppm) and vanadium (32 ppm). All concentrations reported for these samples could possibly exceed STLC limits.

2.1.5 DAMES & MOORE, 1985

1. Based on the results from the 1984 Phase I activities, the City of Santa Fe Springs Redevelopment Agency requested that Dames & Moore conduct a Phase II RI at the Site and adjacent athletic field. This investigation, which was conducted in March 1985, included the collection of 35 shallow soil samples from the Site, the St. Paul High School athletic field, and a vacant lot approximately 1,050 to 1,300 feet to the northwest of the Site (see Figure 2.2). The purpose of the investigation was to evaluate soil conditions and ground water quality in the upper most saturated zone both upgradient and downgradient of the site (see Figure 2.3 for location of ground water monitoring wells).
2. Subsurface soil samples consisted of loose silty sand, fine gravel with occasional asphalt, wood fragments, concrete and plant matter. Analytical results indicated that five surface samples (ranging from 0- to 1-foot in depth) contained lead concentrations which exceed the STLC. However, the lead concentrations were similar to background concentrations, as indicated by the samples analyzed from the vacant lot.
3. Barium, copper and vanadium are present in concentrations below the STLC in samples from the Site, but were not found at all in background samples. Neither of the two surface samples analyzed using Methods 624 and 625 contained detectable concentrations of EPA priority pollutants.

4. The boring log for ground water monitoring well (MW) MW-1, showed 1 foot of silty sand, gravel and concrete fragments, underlain by 2 feet of silty clay with traces of fine sand, underlain by a 1-foot concrete layer. Beneath the concrete layer, black oily sludge occurs to a depth of 14 feet, underlain by 8 feet of sand, traces of clay, and some silt, then very fine to medium sand to a depth of 40 feet. Sand, clayey silt and combinations thereof occur between 40 and 48 feet. This is underlain by sand to a depth of 52.5 feet (water table depth), sand with some silt to 65 feet, and fine to medium sand to 75 feet (Dames & Moore, 1985).
5. Ground water monitoring well MW-2 was originally drilled into one of the sumps that surround the WDI reservoir. The well was abandoned at a depth of 15 feet when it was determined that although there was silty sand with some gravel to a depth of 5 feet, this material was underlain almost exclusively by waste material and free liquid. The location was moved to the west. The log shows silty clay with some sand to 25 feet, underlain by sand and fine gravel to termination of the boring at 77 feet. An interbedded layer of silty clay matrix was found between 33 and 38 feet, and interbedded fine sandy silt and clayey silt occurred between 49 and 52 feet. Water was encountered in MW-2 at 50.5 feet (Dames & Moore, 1985).
6. The boring log for monitoring well MW-3 shows sandy silt, with some clay, brick, concrete and glass fragments to a depth of 9 feet. This is underlain by clayey silt and silty clay (natural soil) to a depth of 23 feet, and by sand to 74 feet, at which point the boring was terminated. An interbedded silty clay and clayey silt matrix was found between 33 and 38 feet. Water was encountered at 50.5 feet (Dames & Moore, 1985).
7. None of the collected water samples contained detectable concentrations of either CAM metals or EPA priority pollutants. Monitoring well MW-3 did, however, contain 12 parts per billion (ppb) of chlordane which exceeds the California Department of Health Services (DHS) action level for chlordane in drinking water (0.55 ppb). It should be noted that MW-3 was installed adjacent to Toxo Spray Dust, Inc. site, a pesticide manufacturing and storage facility.

2.1.6 DAMES & MOORE, 1986 (TOXO SPRAY DUST, INC.)

1. As part of site investigation activities for the City of Santa Fe Springs Redevelopment Agency, Dames & Moore (1986d) collected two samples from the flooring in the former dry-mix area of the Toxo production building located at 12651 East Los Nietos Road on July 1, 1986. Toxo Spray Dust Inc. operated as a pesticide manufacturing and storage facility adjacent to the

reservoir in 1953. On July 9, 1986, six shallow soil vapor probes were installed. Results of this work showed elevated concentrations of pesticide compounds, methane and nonmethane gases which resulted in the DHS requiring that the Toxo Spray Dust, Inc. building be demolished and hauled to a Class I landfill for disposal.

2. In September 1986, the Toxo operations building was demolished. Following the demolition, Dames & Moore collected two soil samples 10 inches below the former building location.
3. The results of the work performed in July and September 1986 showed the following:
 - Floor samples contained methylparathion, ethylparathion and endosulfan II.
 - Sample from vapor probe VP-1 contained 231,000 ppm (23.1 percent by volume in air) of methane and 597 ppm of total nonmethane hydrocarbon as hexane.
 - Soil samples contained malathion, ethylparathion and endosulfan I. Soils also contained concentrations of aldrin, 4,4', DDE and 4,4'-DDT which exceed the State of California TTLC limits for hazardous waste.

2.1.7 DAMES & MOORE, 1986 (CAMPBELL PROPERTY [AREA 7])

1. During May 1986, the City of Santa Fe Springs Redevelopment Agency requested Dames & Moore to conduct an RI to locate and estimate the volume of waste material on the Campbell property (Area 7). This field investigation included the installation of four vapor probes to depths of 5 feet (see Figure 2.4). Total organic vapor concentrations within the soil gas were measured by extracting gas from the soil through the probe with a vacuum pump and analyzing it with an organic vapor analyzer (OVA) and a natural gas indicator (NGI). Six soil borings were also drilled on the Campbell property (see Figure 2.4). Four of these borings (DM-1, 2, 3 and 4) were drilled in areas where drilling muds were previously encountered (i.e., 1981 and 1985 field investigations by EJN & Associates and Moore & Tabor) in the shallow subsurface. Borings DM-4, DM-5 and DM-6 were drilled adjacent to the Site in order to evaluate whether hazardous chemical compounds have migrated across the property boundary.
2. Moderate levels of naphthalene (200 ppb), di-n-butyl phthalate (2,300 ppb) and 2-methylnaphthalene (140 ppb) were found in DM-1 at a depth of 6.0 feet. Boring DM-2 contained moderate to high concentrations of naphthalene (21,000 ppb), fluorene (35,000 ppb), phenanthrene (48,000 ppm), 2-methyl-naphthalene (430,000 ppb) and ethylbenzene (7,500 ppb) at a depth of 8.5 feet. At a depth of 11 feet, boring DM-2 contained

moderate to high concentrations of naphthalene (16,000 ppb), di-n-butyl phthalate (1,300 ppb), fluorene (5,200 ppb), phenanthrene (6,700 ppb), isophorone (4,700 ppb), chrysene (2,200 ppb) and 2-methylnaphthalene (48,000 ppb). Boring DM-3 contained relatively high concentrations of naphthalene (40,000 ppb), fluorene (12,000 ppb), phenanthrene (15,000 ppb) and 2-methyl-naphthalene (78,000 ppb) at a depth of 16 feet. Detectable concentrations of di-n-butyl phthalate (390 ppb) were found at a depth of 3.5 feet in Boring DM-4. Soil pH was found to be between 7.9 and 8.4. All metal concentrations were reported to be below the TTLC and all but three metal concentrations were reported below the STLC, but the exact value of these concentrations was not reported.

3. In June 1986, Dames & Moore installed three shallow (5- to 6-feet) soil vapor probes and performed 21 CPT (cone penetrometer test) soundings at the Campbell property. The purpose of this work was to: (1) better estimate the extent of sumps and associated soft material at the site, and (2) utilize shallow vapor probes to assess the nature and concentration of organic vapors in the soils beneath the site.
4. The CPT soundings show the presence of very soft sump materials possibly including desiccated muds and loose fill. Two approximations for the horizontal extent of the very soft material are shown in Figure 2.5. The inner zone, containing very soft material, has approximate dimensions of 100 feet by 175 feet with an average thickness of 10 feet. Very soft material was encountered as deep as 18 feet. Including the overburden, the inner zone volume would be 10,000 to 12,000 cubic yards, assuming that the outer zone represents the margin of the sump. With generally shallower depths of sump material, the additional volume was estimated to be about 2,000 to 4,000 cubic yards (Dames & Moore, 1986a).
5. Analysis of gas samples indicates 9,500 ppm of methane at a depth of 6 feet in VP-1, no detectable concentration of gas in VP-2, and 11,200 ppm of methane and 29 ppm of total nonmethane hydrocarbon as hexane at a depth of 6 feet in VP-3 (Dames & Moore, 1986a).

2.1.8 JOHN L. HUNTER & ASSOCIATES, 1987

1. On December 8, 1987, four soil samples were collected from the Campbell property (Area 7) by John L. Hunter & Associates, Inc. following the unauthorized discharge of plating solutions to the ground (see Figure 2.6).

2. Results for all samples indicated that metal concentrations were below the TTLC (Hunter, 1988), except for Sample 1 which exceeds the TTLC for nickel. The STLTC was exceeded for: chromium and nickel (Samples 1, 2, 4); copper, zinc and arsenic (Sample 1); and cadmium and lead (all samples). A WET analysis was not performed. Concentration of nitrate varied from 9 to 3,990 ppm although Sample 2 contained no detectable concentration of nitrate. Soil pH varied from 5.6 to 7.9.

2.2 EPA REMEDIAL INVESTIGATION (1988-1989)

1. The location and configuration (size and composition of parcels), history and results of previous investigations at the Site prompted the EPA to conduct an extensive field investigation. EBASCO was tasked by the EPA to perform an RI after the site was listed on the NPL. Major components of the field investigation were conducted during 1988 and 1989 and are summarized in Table 2.3.
2. Boundary, topographic and location surveys were conducted prior to initiating field sampling activities. During these surveys, boring and well locations were established, a datum point for subsurface investigations was established, site drainage patterns were identified, and geologic anomalies were noted.
3. Several geophysical surveys, including electromagnetic conductivity (EM), CPT and ground-penetrating radar (GPR), were also conducted prior to field sampling activities in order to locate the concrete-lined reservoir and find drilling obstructions, and characterize the WDI waste handling and deposition areas. These areas had previously been identified from aerial photos. Final interpretations of the data produced during these tests yielded estimates of depth, relative soil densities and strengths, and a preliminary estimate of the horizontal extent of WDI waste handling areas.
4. In order to evaluate the extent of subsurface soil contamination, 108 soil borings were drilled to a depth of 35 feet at specified locations around the site (see Figure 2.7). Figures 2.8 to 2.10 show analysis results of the boring samples which exceeded industrial PRGs. Approximately 37 borings were drilled in areas where contaminated liquids were suspected of being deposited in unlined sumps. Some borings were located outside of the waste handling areas to determine the extent of contamination migration. Thirteen borings were drilled within the concrete reservoir area, and six borings were drilled on St. Paul High School's athletic field.

5. For the purpose of describing the extent of the contaminated soils, the Site was divided into several distinct areas whose physical and chemical characteristics are discussed in this section. The physical characteristics of these subareas, including the estimated volumes of fill and waste materials, have been summarized in Table 2.4. The extent of contaminated areas were estimated based on the visual identification shown on soil boring logs. These values were preliminary estimates and are not ARARs/Risk-based. The FS will provide the final ARARs/Risk-based volumes of contaminated soil at the WDI (EBASCO, 1989d).
6. The following sections summarize the findings for each area during this investigation. A detailed description of the site physical and chemical characteristics can be found in RI (EBASCO, 1989d). The results of the 1995 WDIG predesign study for Areas 4 and 7 are presented in Section 2.3 of this chapter. Recent investigations (1997 through 1998) are presented in Chapters 3.0 and 4.0.

2.2.1 BURIED RESERVOIR

1. Thirteen soil borings were drilled within the perimeter of the reservoir (see Table 2.4). These borings and aerial photos indicate that the sides of the reservoir are not vertical but slope inward. Borings contacted the concrete bottom of the reservoir from 18 to 23 feet below ground surface (bgs) (the difference may be accounted for by sunken debris). The reservoir appeared to be covered with 5 to 15 feet of artificial fill (both soil and debris). The fill was 5 feet thick at the northern edge of the reservoir and thickened to 15 feet at the southern edge. Borings completed in the reservoir indicated a black viscous material, similar to drilling muds and crude oil. The WDI reservoir contained the majority of the site wastes. Based on the soil boring logs, the average thickness of waste material in the reservoir was about 15 feet which was covered with approximately 5 to 10 feet of fill material. Estimated volumes of the fill and waste materials are respectively 58,000 and 175,000 cubic yards.

2.2.2 AREA 1

1. Sixteen soil borings were drilled in this area (see Table 2.4). Fill material occurred in the borings in the middle of the area and tapered off at the edges, becoming very thin in the border borings. The stratigraphy of Area 1 was characterized by interbedded clays from 5 to 20 feet bgs. Overlying this layer near the center of the area, sand and silt was found between 10 and 20 feet bgs, with fill and waste material above this layer to the surface.

2. In boring SB-033, black, silty material was found from surface level to 10 feet bgs. Native clay was present at 10 feet bgs. Boring SB-044 repeated this sequence, but the waste material contained more clay, possibly containing drilling muds. Boring SB-054 contained black sludge at 5 feet and sandy silt with black streaks at 10 feet bgs. The silt layer was still present at 15 feet bgs and the native clay layer appears 5 feet below that. The waste material did not extend south to SB-081. This boring exhibited natural clay layers through the first 20 feet with sand and clay layers alternating below this section.
3. As determined from the boring information in Area 1, the upper 5-feet of soil was covered by fill material and asphalt. Contaminated soil occurred at depths ranging from 10 to 25 feet bgs. The estimated volumes of waste and fill materials was respectively 48,000 and 16,500 cubic yards.

2.2.3 AREA 2

1. Area 2 consisted of land surrounding and immediately adjacent to the reservoir. Twenty-two soil borings were located inside the area boundaries and seven soil borings were located between the interior of Area 2 and the outer edge of the reservoir (see Table 2.4). Borehole logs showed that most sections of Area 2 were covered with fill material. The fill on the eastern side of the waste handling area varied in thickness from 0 to 10 feet. In the northeast corner, the thickness of fill material varied from 10 to 15 feet. Along the south border, the thickness of fill varied from 5 to 10 feet.
2. Borings in the northwest corner of Area 2 confirmed that a large pocket of waste material extended to a maximum depth of 20 to 25 feet bgs. Sludge and, in some cases, free liquids occurred between 7 to 10 feet bgs, just under the fill material. Most borings showed sludge and with occasional free liquids underlain by a 5-foot clay layer. Borings in the northeast corner of Area 2 contained 5 to 15 feet of brown to tan sandy silt with large amounts of rubble (i.e., fragments of concrete and brick) underlain by waste material from 5 to 20 feet bgs. At a depth between 15 to 20 feet bgs, a brown clay layer was found.
3. Borings completed in the northern portion of the reservoir may have been impacted by some lateral seepage of waste materials around the northern crown of the reservoir, but the extent of contamination did not appear to be extensive. SB-011 and SB-012 showed no signs of the waste material and therefore, the northern extent of the material was placed at approximately

20 feet south of these borings based on the aerial photos. In the southwest corner of Area 2, fill varied in thickness from 5 to 10 feet and was underlain by 10 to 20 feet of black sludge.

4. Seven borings were located in the transition area between the reservoir and Area 2. The reservoir and Area 2 were apparently separated by an earthen berm as indicated by these borings. Minor amounts of contaminated material was observed in these borings, most likely due to waste handling in the neighboring areas. Clay layers beneath all portions of Area 2 were underlain by fine to coarse grained sand.

2.2.4 AREA 3

1. No soil borings were drilled in Area 3 since based on aerial photographs, liquid waste was not disposed of in this area. Based on boring logs from surrounding boreholes, Area 3 appeared to have been covered with approximately 10 feet of fill material. The estimated volume of fill material was 9,500 cubic yards. Below the fill layer was about 10 feet of silt which was underlain by at least 15 feet of sand.

2.2.5 AREA 4

1. Four borings, were located within this area. Boring logs indicated that a brown, silty, sandy fill was present from the surface to a depth of 5 feet bgs to a depth of 10 feet bgs. Blocks of orange tile and other concrete rubble were present throughout this fill layer. Soft, dark gray to black waste material occurred directly below this fill layer and extended to about 20 feet bgs. Below 21 to 25 feet a gray silty clay layer was present which grades to fine sand and coarse sand below.
2. On the border between Area 3 and Area 4, fill material occurred to a depth of 5 feet bgs. The fill material was underlain by 5 to 10 feet of stiff, black silt and a clay mixture layer. Silt, clay and sand were observed 25 feet bgs with no visible contamination. Along Greenleaf Avenue, borings indicated fill material from 0 to 7 feet bgs. No waste material occurred along the boundary. Silt and clay grade downward to sand only. The sand layer started at 25 feet bgs.
3. Aerial photographs suggest that an area covered by liquid waste had an approximate rectangular shape with estimated dimensions of 260 feet by 220 feet. A narrow 20-foot strip near Greenleaf Avenue was relatively free of contamination. Estimated volumes of the fill and waste materials in Area 4 were respectively 9,500 and 34,000 cubic yards.

2.2.6 AREA 5

1. No standing liquids were shown in this area by aerial photos. Three soil borings were drilled in this area. According to the boring logs, the area was underlain by 5 feet of fill material. Below the 5 feet depth, silty clay, and clay materials were present to the depth of 20 feet, underlain by sand to the borings termination depth of 35 feet. Soil samples from this area did not show any visible contamination. The estimated volume of fill material covering the area was 5,800 cubic yards.

2.2.7 AREA 6

1. Four soil borings were located within the area boundaries. Boring logs showed that the upper 5 feet of soil consisted of dark brown silt and sand fill material underlain by a dark brown to gray clay with some silt from 5 to 20 feet bgs. A native sand layer was below the clay layer appearing between 20 feet and 35 feet bgs. Another clay layer occurred below the sand layer down to the deepest extent of the soil borings, 35 feet bgs. This area appeared relatively free of visible contamination.

2.2.8 AREA 7

1. Seven soil borings were located in this area. According to the boring log for SB-090, the contaminated area was covered by approximately 5 feet of fill material consisting of silty clay and rubble. The fill layer was underlain by 5 to 10 feet of partially contaminated fill and wet, visibly contaminated, black to dark gray waste material. Dark gray, wet, drilling mud was present in this boring from 10 feet to 20 feet bgs. Below 20 feet, the boring log described a native, fine to medium grained sand with no visible contamination.
2. The remaining 6 soil borings showed no visible contamination. These borings indicated that the upper 5 feet bgs consisted of fill material underlain by native silty, clayey layer to 10 to 20 feet bgs. Fine to medium grained sand was present below this silty layer.
3. Aerial photographs suggest a was area with a rectangular shape with dimensions of approximately 180 feet by 100 feet. Based on the 1945 aerial photo and boring logs, the waste handling area appeared to have been centered around SB-090. The waste materials were

contained between depths 10 to 20 feet bgs. The upper 10-foot soil was mainly fill material but it was partially contaminated below 5 feet bgs. The estimated volumes of fill and waste materials were respectively, 5,700 and 3,900 cubic yards.

2.2.9 AREA 8

1. Aerial photos suggest that standing liquids were present in this area at some time. Many small businesses were within the area boundary including Stansell Brothers, Colorplus Graphics, A and H Auto Body, Reyes Containers, Terry Trucking, I.C.E., Bolero Plastics, Timmons Wood Products, Dan Ray, California Reamer, Davco, World Wide Plastics, H.H. Contractors and Rick's Smog Service. The property formerly owned and operated by Toxo Spray Dust, Inc. was also included in this area (EBASCO, 1989a). Some excavation and grading had occurred in preparation for small business development.
2. Eleven soil borings were located within this area. Fill material was found from the surface to 5 feet bgs and was underlain by waste material (dark gray silty material and black sludge) at depths between 7 to 15 feet. Below the waste material, a sand and silt layer was present to a depth of 20 to 50 feet which was underlain by clay. Three borings, SB-076, SB-087 and SB-093 appeared to be free of visible contamination. Below the top 5 feet of fill material, each of these borings encountered 10 to 15 feet of native clays. These clays were underlain by sand to the depth of 35 feet.
3. Borings SB-082, SB-093 and SB-094 near the perimeter, had no waste materials present and showed no visible contamination. The upper 20 feet of soil in these borings consisted of clay and silt with clay and sand dominating at 20 feet bgs.
4. Area 8 appeared to be moderately contaminated at depths ranging from 15 to 20 feet bgs, except for an area (135 feet by 300 feet) near the middle of Area 8. The estimated volumes of the waste material and the fill that covers the area are respectively 85,000 and 36,000 cubic yards.

2.2.10 AREAS UPGRADIENT OF RESERVOIR

1. St. Paul's High School and Fedco Distribution center are located upgradient of the site. Six borings were completed on the school's athletic field. No waste dumping could be inferred from aerial photos, although in 1962, the 1988-1989 RI report speculated that a spill

from the WDI reservoir may have resulted in overland run-off from the site coming in contact with the St. Paul's High School athletic field. However, layers of silt, clay and sand beneath St. Paul's High School and Fedco appeared to be undisturbed.

2.2.11 GROUND WATER CONDITIONS

1. Twenty-seven of the soil borings were converted into ground water monitoring wells in order to determine the extent of ground water contamination. The location of these wells is shown in Figure 2.11. Of the 27 groundwater monitoring wells installed, 21 were shallow wells designed to sample the uppermost aquifer. These wells were completed at the water table, to a depth of approximately 65-70 feet. The remaining wells were completed to deeper depths.
2. In general, ground water had been encountered at a depth of 46 to 65 feet bgs and from 91 to 106 feet above mean sea level. Accordingly, ground water was approximately 34 to 44 feet below the bottom of the WDI reservoir and 22 to 47 feet below the bottom of the WDI waste handling areas.
3. Ground water level elevations at the Site were measured several times between September of 1988 and January 1989, although only two sets of measured water level elevations include a sufficient number of data points to develop ground elevation water maps (see Figures 2.12 and 2.13). (Note: the data used in construction of these maps include only the data from shallow wells and as such represent conditions in the uppermost aquifer underlying the site.)
4. Both ground water elevation maps indicated that ground water flow was generally in a southwest direction. These results were consistent with the findings in the 1985 Dames & Moore study. According to this data, near the Campbell property and the Dia-Log property, the flow was slightly to the south and to the west. The 1988-1989 RI report indicated that ground water in these areas may possibly be following along narrow channels with higher permeabilities than the surrounding media.
5. The ground water chemical analysis results were compared against State and Federal drinking water standards. Comparison of chemical data from the upgradient and downgradient wells are used to identify if elevated levels of chemical compounds in ground water has been caused by migration of contaminants from the WDI waste handling areas.

6. Samples of ground water were collected from GW-01 and GW-02, both wells which are installed upgradient of the WDI reservoir. Aluminum and selenium were found in both of these wells in concentrations above the Safe Drinking Water Act (SDWA), Primary Maximum Contaminant Level (MCL), standards. Concentrations of iron and manganese in these wells also exceed the Secondary MCL. Chromium was detected in concentrations above the MCL standard in well GW-01 only. Arsenic, barium, copper, lead and zinc were found in both upgradient wells but at concentrations lower than the MCL standards. Calcium, magnesium, potassium and sodium were also found in both wells. Concentrations of cobalt, nickel, and vanadium were also detected. Volatile organics, semivolatile organics and pesticides/PCB compounds were not detected in these upgradient wells.
7. Since metal concentrations in the upgradient wells appeared to be very different, GW-01 was resampled on to confirm the validity of the data. Concentrations of detected metals in the unfiltered samples in the second round of sampling appear to be slightly lower than that from the first round of sampling. In comparing the results of first and second round of samples, no specific reason could be attached to the consistently lower metals concentrations in the results of second round of samples. The duplicate nonfiltered samples show concentrations similar to the original second round samples indicating consistency of sampling analyses and the integrity of samples during the second round of sample collection.
8. Numerous metals were detected in samples collected from ground water monitoring wells located within the Site boundaries. The following summarizes these results:
 - Aluminum was detected in 25 of 27 ground water monitoring wells. Twenty-three (23) wells show aluminum concentrations above the MCL of 1,000 ppb established by the SDWA. Aluminum was also detected in the upgradient wells.
 - Arsenic, barium, copper, lead, mercury, silver and zinc were found in more than one well but at concentrations below the MCLs.
 - Calcium was found in all wells. Concentration of calcium ranges from 187 to 354 ppm. The highest concentration was found in GW-01 which is an upgradient well.
 - Chromium was detected in 19 wells but only GW-01 which is an upgradient well and GW-27 which is located near the southern end of the site contain concentrations above the MCL standard.
 - Cobalt was found in wells GW-01 (49 ppb), GW-09 (21 ppb) and GW-23 (16 ppb).
 - Iron was detected in 26 wells. Concentration of iron exceeds the MCL standard in 24 of these wells. The range of iron concentration is from 221 to 79,300 ppb. The highest iron concentration was found in GW-01, an upgradient well.

- Magnesium was found in all wells. Concentration of magnesium ranges from 59 to 114 ppm. Magnesium was detected both upgradient and downgradient from the site.
 - Nickel was found in 11 wells. The nickel concentration ranges from 24 ppb to 79 ppb. The highest concentration was found in GW-01, an upgradient well.
 - Concentrations of manganese were detected at all wells including the two upgradient wells, GW-01 and GW-02. Concentrations above the MCL standard were found in 24 wells. Manganese concentrations ranged from 20 to 5,850 ppb. The highest concentrations of manganese were found in GW-13, GW-14, GW-15 and GW-21 with concentrations between 4,010 to 5,850 ppb. The first three of those wells are located downgradient of the reservoir.
 - Potassium was detected in all wells. The concentration of potassium ranges from 5,240 to 18,400 ppb. The highest concentration was detected at GW-01, an upgradient wells.
 - Concentrations of selenium were detected in 26 wells. Twenty-five (25) wells had concentrations above the MCL. The highest concentration of selenium was detected in GW-01, an upgradient well.
 - Sodium was detected in all wells. Sodium concentration ranges from 102 to 190 ppm. The average sodium concentration for the two upgradient wells is approximately 140 ppm.
 - Vanadium was detected in 10 monitoring wells. The highest concentration of vanadium was found in GW-01, an upgradient well.
9. Five volatile organic compounds (VOCs) were detected in the ground water. However, the concentrations of the VOCs are much lower than SDWA MCLs and DHS action levels. Trichloroethene (TCE) is the only VOC found in a concentration (18 ppb) above the MCL standard (5 ppb) in well GW-26. Acetone, a common laboratory contaminant, was found in GW-30. Concentrations of toluene (1 to 5 ppb) were detected in nine wells. Tetrachloroethene (PCE) was found in GW-11 and GW-21. Chloroform was found in the wells GW-06 and GW-07.
10. Four SVOCs were detected in the ground water. Bis (2-chloroethyl) ether was detected at well locations GW-06, GW-07, GW-19 and GW-31. Concentration of this compound ranged from 260 ppb at GW-06 to 690 ppb at GW-19. A concentration of 36 ppb diethylphthalate was detected in GW-05. Concentrations of Di-n-butylphthalate (2 ppb) were found in GW-07 and GW-31. A concentration of 9 ppb of Di-n-octylphthalate was detected at GW-07. All three phthalate compounds are common lab contaminants.
11. Pesticides and PCB compounds were not present in detectable concentrations in the ground water samples.

2.2.12 SUBSURFACE GAS CONDITIONS

1. A subsurface gas investigation was performed by converting 26 soil borings into subsurface gas monitoring wells. The locations of the subsurface gas monitoring well, are shown in Figure 2.14. A total of 28 subsurface gas samples were analyzed for basic gases and trace contaminants.
2. The results indicate that there are large variations in the trace organic gases distributed across the site and to some extent the ratio of major gases identified as well. Figure 2.15 shows the analytical concentrations of chloroform along with trichloroethane, trichloroethene, and tetrachloroethene. Figure 2.16 shows the analytical concentrations of benzene along with TCE and perchloroethene detected. Figures 2.15 and 2.16 have been presented because there appears to be a correlation between the presence or absence of these gases with each other. Figure 2.17 shows the percentage of methane comprised in the total gas volume. This figure is important because methane is often an anaerobic degradation product of organic rich material or waste and could represent an explosion hazard if concentrated inside a confined space like a building.
3. The analytical results also identified the presence of vinyl chloride in wells VW-4 (73 parts per billion per volume [ppbv]) and VW-9 (3,300 and 12,00 ppbv in replicate samples) adjacent to and within the reservoir and VW-14 (110 ppbv) about 180 feet west of the reservoir. The replicate samples collected from VW-9 showed a large variation in analytical concentrations of vinyl chloride, however this is not uncommon in subsurface gas sampling. The important point is that collection of subsurface gas is difficult to reproduce with much precision.
4. The detection frequency of these gases ranged from approximately 4 percent to 100 percent. PCE was the most prevalent organic gas present in the subsurface media at the Site. Trichloroethene had the highest average concentration among the detected compounds and vinyl chlorine shows the highest concentration of any compounds but it was detected in only three wells.

2.2.13 1988-1989 RI REPORT CONCLUSION

1. The 1988-1989 RI concluded that the WDI reservoir contained most of the contamination with high concentrations of metals and VOCs. Ground water under WDI was relatively free of contamination. Certain areas used previously as waste handling areas also contained elevated levels of contamination. These areas were not lined and therefore, waste presence and migration in the subsurface may be considered as a potential health hazard in these areas. However, for the most part, soil contamination in these areas appeared to be bound to the soils and are relatively immobile.

2.3 WDIG PREDESIGN ACTIVITIES (1995)

1. The 1995 Predesign Activities conducted by the WDIG were focused primarily on investigating soil conditions in Site Areas 4 and 7, as shown in Figure 2.18, and confirming earlier EPA soil gas and ground water findings.

2.3.1 AREA 4

1. Sixteen shallow hydraulically-pushed borings and six intermediate to deep hollow-stem auger borings were installed in or adjacent to Area 4 at the locations shown in Figure 2.19. These activities occurred in June 1995.
2. Generally three material types were encountered, and are listed below:
 - Fill Material
 - Sump Material
 - Native Soil
3. Fill material was generally composed of silty sand and with various construction materials (e.g., concrete and brick fragments, debris). Fill material was encountered at the surface to depths ranging between 5 and 15 feet bgs. The material was generally characterized as loose; and dry to very moist (free liquids were not encountered); infrequently observed organic odors were slight.
4. Sump material was identified as sands and silts, stained to saturated with oily substances and having hydrocarbon odors. The sump material exhibited low density, high plasticity and generally contained a higher moisture content than the overlying material. A few zones were identified to be above the liquid limit.

5. Native soil was identified as either silt or poorly-graded sand. The silts were encountered overlying the sands. The soil was characterized as medium stiff to stiff and medium dense to dense. Moisture content was described as moist and the soils did not exhibit oil staining or odor. Ground water was not encountered in the borings to a depth of 40 feet.
6. Selected soil samples were analyzed for the following contaminants of concern:
 - Arsenic
 - Beryllium
 - Chromium
 - Cadmium
 - Lead
 - Thallium
 - VOCs

Other contaminants of concern were not identified in this area during the RI.

7. The results of the soil chemistry analysis for both Areas 4 and 7 are summarized in Figures 2.19 and 2.20. The results indicate that other than thallium and beryllium the ROD contaminants of concern were not exceeded in Area 4. However, as discussed in the Workplan, thallium and beryllium cleanup standards (residential PRGs) are below area background levels.

2.3.2 AREA 7

1. Thirteen shallow hydraulically-pushed borings and one deep hollow-stem auger boring were drilled in Area 7 at the locations shown in Figure 2.20. One less deep boring was installed than proposed because the limits of the sump material were adequately defined without it. These borings were completed during June 1995.
2. The material types encountered were similar to those found in Area 4, namely fill material, sump material and native soil.
3. The limits of the sump material encountered are shown in Figures 2.19 and 2.20. The areal extent is approximately 15,000 square feet, while the greatest vertical extent is 18 feet in Boring SB-090.
4. Area 7 soil samples were analyzed for the same contaminants of concern as listed above for Area 4, plus potentially carcinogen polyaromatic hydrocarbons (pcPAHs), carcinogenic polyaromatic hydrocarbons (cPAHs) and PCBs. The results indicated that two isolated metal

(chromium and arsenic) exceedances were noted (in Borings HPB-7-01 and HPB-7-05), the sump material. No organic exceedances of ROD cleanup standards were detected. As discussed above for Area 4, thallium and beryllium concentrations are associated with background conditions.

5. One isolated location of elevated hydrocarbon, was observed in Boring HPB-7-01. Accurate quantification of the contaminants could not be determined, however, because of apparent matrix interferences on analytical samples due to high oil content in the sample. The identified organics (e.g., 2-methylnaphthalene, naphthalene and phenanthrene) are noncarcinogenic constituents. There were no exceedances of organic contaminants of concern in this boring, however, the detection limit for the 8-foot deep sample was raised due to matrix interferences.

2.3.3 SOIL GAS MEASUREMENTS

1. Soil gas measurements were performed in the available site vapor wells in June 1995. These measurements were performed by initially performing field screening tests on each well using a field operated flame ionization detector (FID) and a gas chromatogram. These instruments were used to analyze for methane and VOC concentrations, respectively. Results of this screening exercise were used to select six wells (20 percent of total wells) to provide samples for analysis in an analytical laboratory. Vapor wells (VW) VW-18, -25, -07, -02, -04 and -14 were selected for laboratory analysis. Laboratory samples were collected using stainless steel summa canisters. The samples were analyzed for methane using South Coast Air Quality Management District (SCAQMD) Modified Method 25.1 and VOCs using EPA Method TO-14. EPA representatives provided oversight and collected split samples.
2. Results of the soil gas measurements are shown in Figure 2.21. This figure illustrates the locations of the vapor wells and summarizes the results of both the field screening and laboratory analyses.
3. Results of the screening and analysis indicated generally low levels of methane (e.g., generally less than 5 percent) and low concentrations of VOCs (e.g., generally less than 1 ppm). The results are summarized by site area below:
 - Area 2 - Soil gas concentrations ranging from 0.3 to 9.34 percent methane with VOCs ranging from nondetect to less than 1.4 ppm. Subsurface gas measurements conducted during the RI indicated concentrations ranging from 0.0 to 39.18 percent methane with VOCs ranging from 0.003 to 16 ppm.

- Area 4 - Soil gas concentrations of 0.0 percent methane and VOCs were not detected.
- Area 7 - Soil gas concentrations ranging from 0.0 percent to a single well with 18.5 percent methane and VOCs ranging from nondetect to less than 1 ppm concentrations.
- Other Site Areas - Soil gas concentrations ranging from 0.0 to 4.0 percent methane and VOCs ranging from nondetect to 5.2 ppm.

As shown in Figure 2.18, most methane concentration observations are consistent with results from the 1988-1989 RI.

2.3.4 GROUND WATER ANALYSIS

1. Two ground water monitoring events were performed at the site as part of the Predesign field investigations. The first was completed in June 1995 and the second in September 1995.
2. As discussed in Section 2.5 and in Appendix A of the Predesign (60%) Design Report, the first sampling episode had field sampling difficulties (TRC, 1995b). The data confirm that the ground water quality has not been impacted based on the consistency of sample results upgradient, beneath and downgradient of the site.
3. Figure 2.22 shows the locations of the ground water monitoring wells and the ground water flow-gradient and direction based on the 11 sampled wells.
4. A distinct rising trend is noted between October 1988 and June 1995, with a leveling trend occurring sometime prior to June 1995. If the ground water levels were to continue to rise from current levels, it could possibly come in contact with sump materials at the Site. Table 2.5 summarizes the ground water elevations in 11 site wells since 1988. An investigation as to the causative mechanism for this trend was performed and is discussed below.
5. The data indicates an average increase in elevation of 12.68 feet over the period of October 1988 to June 1995, with the highest changes occurring between late 1991 to present.
6. The following documents were obtained and reviewed for this investigation:
 - Division 18 of Annotated California Codes, Official California Water Code Classification Volume 70A.
 - Report of Watermaster Service in the Central Basin, Los Angeles County, October 1994.

- 1994 Annual Survey and Report on Ground Water Replenishment, Water Replenishment District of Southern California.
 - Appendix A of State of California Department of Water Resources Bulletin No. 104, Planned Utilization of the Ground Water Basins of the Coastal Plain of Los Angeles County, 1961.
7. The Site is located in the Montebello Forebay of the Central Basin. The Montebello Forebay is the principal recharge area for the basin. The Rio Hondo and San Gabriel River spreading grounds are located approximately three miles from the site. The spreading grounds overlie an area of the Forebay where the Basin's aquifers can be recharged from the surface; in the rest of the Basin the aquifers are separated by aquitards that would inhibit or prohibit the percolation of surface recharge to all of the aquifers.
 8. The Water Replenishment District of Southern California (WRD) was formed in 1959 to manage the Central and West Coast ground water basins in accordance with the provisions of Division 18 of the California Water code. The WRD's primary objectives are to provide high quality water to its pumpers, minimize the adverse effects caused by years of overpumping and oversee ground water recharge operations in the two basins.
 9. The WRD purchases water imported through the State Water Project and the Colorado River Project to supplement annual rainfall to replenish the ground water basins. Purchased water is then placed in the aforementioned spreading grounds to recharge the lower potable aquifers.
 10. The WRD monitors and regulates the amount of water stored in the basins in order to maintain an adequate supply during drought years. The WRD's objectives do not include replenishing the shallow aquifers of the basin; due to the present urban condition over these units the return of historical water levels would be detrimental to current development and construction. The Site is situated over the shallow aquifers.
 11. The Forebay experienced some large declines in the early and late 1970s because of reductions in the amount of water used in the spreading grounds for recharge. However, overall the water levels have stabilized at near optimum levels since the mid-1960s. During the last few years water levels in the Forebay have increased another 5 to 10 feet due to the continued aquifer replenishment operations, and "as a result the Forebay is slightly above optimum operating levels" (WRD, 1994). The WRD recognizes the need to avoid overcharging ground water to levels that might come in contact with shallow soil contamination in the densely developed areas of the basin. Given continued aquifer replenishment operations the "WRD

anticipates that water levels in the Montebello Forebay will remain at about the same level or drop slightly" (WRD, 1994) because optimum ground water levels have been reached in the basin. Since this review of available ground water data in the basin indicates that the ground water level rise was created by basin replenishment activities, no further rise is anticipated to occur. Additionally, it should be noted that ground water laboratory analysis data has not shown significant changes to ground water quality since the August 1992 analytical results.

12. The results of the September 1995 sample round indicated that the rising ground water elevation trend has been slowed significantly, as is expected given the WRD activities. Based on this investigation, it does not appear that the ground level conditions will cause site conditions to impact ground water conditions.

2.4 PRIOR SITE INVESTIGATION DATA EVALUATION

1. The prior site investigation data presented in this chapter was used as the basis of the following additional site investigations:
 - 1995 WDIG Predesign Activity
 - 1997-1998 EPA RD Investigation Activities
 - 1997-1998 WDIG RD Investigation Activities
2. The data developed and presented in Chapters 3.0 and 4.0 were collected to compare and confirm the results of the prior site investigations, and were used in the development of Chapter 5.0, the Comprehensive Summary of Site Conditions.

3.0 1997 - 1998 EPA RD INVESTIGATIVE ACTIVITIES

1. The following sections present the objectives, findings and interpretations of the various studies completed from 1997 to 1998 by CDM Federal Programs Corporation (CDM Federal) and Response Engineering and Analytical Contract (REAC), on behalf of the EPA/Environmental Response Team Center (EPA/ERTC). The conclusions of EPA's (CDM Federal and ERTC/REAC) investigations of soils, soil gas, reservoir conditions and ground water are also summarized below. Each media is discussed in a separate section.
2. Chapter 4.0 (1997-1999 WDIG RD Investigative Activities) provides information on the findings made by WDIG during their field investigations conducted from 1997 to 1998. The information below does not necessarily concur with WDIG's findings in every instance. Chapter 5.0 (Comprehensive Summary of Site Conditions) includes several tables comparing EPA's and WDIG's findings.

3.1 SOIL CONDITIONS

3.1.1 AREA 7 GEOPROBE CHARACTERIZATION

1. In August 1998, ERTC/REAC conducted a geoprobe investigation (i.e., collection of several 1-inch diameter continuous cores, see Figure 3.1) of Area 7 to: (1) characterize the buried wastes, including the characteristics and location of contaminated soils and liquids; and (2) locate a possible perched liquids zone for application of vacuum-enhanced extraction technology for removal of gases and liquids from the buried waste (ERTC, 1998).
2. Based on information collected during this investigation, ERTC/REAC made the following observations and conclusions:
 - Fill material is approximately 16 to 20 feet deep, consists of a silt to sandy silt matrix with concrete and other debris.
 - Fill material appears to be underlain by a natural, undisturbed, fine, well-sorted sand or, in some places, possibly a silt.
 - Stained soil containing oily liquids exists in the area (see Figure 3.2).
 - Extent of soil staining is on the order of 200,000 cubic feet (ft³).
 - Volume of soil containing liquids is approximately 50,000 ft³.
 - Liquid volume is approximately 2,500 ft³ (18,700 gallons).
 - Approximately 1,900 gallons (10 percent of liquids) may be recoverable.
 - Presence of drilling mud makes vacuum-enhanced extraction inappropriate for removal of liquids.

3.2 RESERVOIR CONDITIONS

3.2.1 RESERVOIR PHYSICAL CHARACTERIZATION

1. To further evaluate the physical characteristics of the reservoir conditions, ERTC/REAC conducted several investigations of the subsurface in the reservoir area (ERTC, 1999a).

These subsurface investigations included the following:

- Historical Map Review
 - Geophysical Survey (Dipole-Dipole Resistivity and Terrain Conductivity)
 - Contents (Chemical and Physical) Characterization
 - Structural Characterization
-
2. ERTC/REAC objectives for each of the investigations noted above were as follows:
 - Historical Map Review:
 - Provide information that would help the geophysics investigators locate the reservoir's boundary and provide guidance for planned invasive trenching investigations.
 - Geophysical Survey (Dipole-Dipole Resistivity and Terrain Conductivity):
 - Determine the location and dimensions of the concrete-lined reservoir underlying the Site. In addition, to identify areas outside of the reservoir where fluids may have leaked laterally from the reservoir and to delineate the thickness and configuration of the water table aquifer.
 - Contents (Physical and Chemical) Characterization:
 - Physical: Collect lithology information and fluid data (i.e., composition and respective thickness) within the reservoir boundary by installing 1-inch-diameter piezometers at varying depths.
 - Chemical: The objectives and complete description of ERTC/REAC chemical characterization of the reservoir are provided later in this chapter in Section 3.2.2.
 - Structural Characterization:
 - Locate the reservoir boundary, investigate if free liquids were present along the interior and exterior edges of the reservoir, inspect the surrounding soil for evidence of contamination (staining), and to determine the physical characteristics and integrity of the reservoir through field trenching activities.
 3. A summary of the findings from the ERTC/REAC investigations is provided below:
 - Historical Map Review:
 - ERTC/REAC concluded that review of site maps provided relevant information regarding the location of the reservoir, as well as the site's topographic data (ERTC, 1999a).

- Geophysical Survey (Dipole-Dipole Resistivity and Terrain Conductivity):
 - Dipole-Dipole Resistivity Results:
 - ERTC/REAC believes "the interpretation of the dipole-dipole resistivity data is somewhat ambiguous, mainly because of the inherent nature of the technique and the lack of boring data against which the survey might be calibrated." Figure 3.3, reproduced from the ERTC's report, provides an east/west cross section showing the dipole-dipole resistivity results. Three "anomalies" were identified for the geophysical survey:
 - Anomaly 1 represents the reservoir edge and dry berm material.
 - Anomaly 2 includes most of the remaining material, both inside and outside of the reservoir.
 - Anomaly 3 includes a small area of high resistivity values, close to the surface and outside of the reservoir. Spectrum, ERTC's contractor that performed the geophysical survey, attributes the anomaly to high resistivity hydrocarbon sludge or hydrocarbon saturated soils.
 - WDIG performed two "calibration" borings by collecting continuous geoprobe samples to approximately 20 feet along the same axis as the survey. Locations were chosen by ERTC/REAC personnel. The purpose of the "calibration" borings were to verify ERTC/REAC data. Results of the samples did not match ERTC/REAC findings.
 - Terrain Conductivity Results:
 - Terrain conductivity surveys provide two types of measurements. The in-phase results were successful in generally locating the berm and edges of the reservoir. The diameter of the reservoir as determined by the geophysical methods is about 25 feet less than that determined from maps and drawings of the site. In some portions of the circular anomaly marking the general edge of the reservoir, the data contour lines are less dense. These may be areas where the berm has been breached or is partially missing.
- Contents (Physical) Characterization:
 - Piezometers were used to determine the distribution of the liquids within the reservoir, however the phase (nonaqueous/aqueous) thickness data should only be taken as a rough estimate of true thickness. Figure 3.4 shows location of piezometers in reservoir. Figure 3.5 shows reservoir cross section and piezometer construction.
 - Reservoir fill material includes silt, drilling mud, concrete, brick and wood.
 - Liquid levels were encountered at varying depths ranging from 4 to 12.5 feet bgs.

- Structural Characteristics (observations conducted by trenching activities):
 - Reservoir Measurements:
 - The reservoir's concrete liner varies from 3 inches to 4 inches in thickness and has a 1/4-inch reinforcement wire mesh through the middle of the liner. The liner walls slope toward the center at an angle of 27 degrees as measured in the field.
 - The reservoir concrete liner has been measured by geophysical methods (Spectrum Geophysical Investigation, Appendix B, ERTC, 1999a) to be 575 feet in diameter, but was probably at least originally 600 feet in diameter before the top of the cement wall was broken down several feet for filling and surface grading. During intrusive activities, a berm width of 40 feet was measured at a depth of 6 feet. The measured thickness of the berm is approximately 22 feet and is composed of fine, reddish-brown clay.
 - The current depth of the reservoir is believed to be approximately 14 feet bgs on the eastern side and 12 feet bgs on the western side, relative to the existing ground surface.
 - Reservoir Observations:
 - Figure 3.6 shows ERTC/REAC excavation locations. Overall the reservoir wall appeared to be intact with the exception of the following:
 - At the 12:00 location, the concrete wall was found to be missing to an unknown depth. Excavated material contained a considerable amount of very large rocks and concrete blocks. The clayey berm (mix of red and gray clay) surrounding the outer boundary of the reservoir was compromised, revealing a heterogeneous material, and dark staining to 7 feet beyond (away from) the reservoir wall.
 - At the 1:00 location, the concrete wall was cleanly cut (vertically). An apparent "makeshift" wall of large rocks and concrete debris was set back away from the reservoir, approximately 2 feet from where the existing concrete wall was located. Berm material showed evidence of dark staining 7 feet beyond the concrete wall toward the St. Paul High School athletic field, to a depth of approximately 8 feet.
 - At the 3:00 location, the reservoir wall was encountered at approximately 6 feet bgs, and revealed several vertical and horizontal fractures.

3.2.2 RESERVOIR CHEMICAL CHARACTERIZATION

1. ERTC/REAC analytical results obtained from the analysis of aqueous, organic liquid, and vapor samples collected from within the reservoir grid are discussed below (ERTC, 1999b). The sample locations for the reservoir chemical characterization are shown in Figure 3.7.

2. Chemical characterization of the contents of the reservoir was performed to meet the following objectives:
 - Differentiate among the liquid-types found in the reservoir; aqueous, light nonaqueous liquids and dense nonaqueous liquids.
 - Chemically characterize the constituents of the liquids for the following two purposes:
 - Determine VOC composition for the purpose of evaluating VOC generation potential for final remedy design consideration.
 - Determine the chemical composition of hazardous substances for the purpose of evaluating liquids disposal options as part of the final remedy.
3. The results of the reservoir chemical characterization indicated the following conditions:
 - Elevated PCB levels in Piezometer P-3, EX-1 and EX-2. Refer to Figure 3.7 for the location of the wells.
 - Elevated METHANE levels in the southwest quadrant of the reservoir.
 - The presence of crude oil constituents (SVOCs) in the reservoir liquids.
 - Low levels of chlorinated solvent, degradation products and vinyl chloride in some areas of the reservoir.
 - Benzene detected in all samples but P-3. Toluene, Ethylbenzene and Xylene were detected in all samples.

3.2.3 PIEZOMETER STUDY

1. CDM Federal installed 62 1-inch-diameter piezometers within the reservoir boundary as part of EPA's reservoir liquids investigation. The objective of CDM Federal's reservoir characterization study was to collect soil data to characterize the reservoir contents across the reservoir and to evaluate the presence and types of liquids found above or within the waste mass (CDM, 1999c). The overall intent of the program was to collect data that could be used to identify areas of the reservoir amenable for liquids removal.
2. The following observations and conclusions were made by CDM Federal based on information collected during the investigation:
 - Waste material consists of fill soil (silt), construction debris (cement, bricks, wood), muds and oily-wastes.
 - 52 of the 60 boreholes exhibited liquids in the soil cores.
 - Over time (24 hours) all of the probes exhibited liquids.
 - Liquid levels ranged from surface to approximately 6 to 8 feet bgs.
3. CDM Federal concluded that the results of the piezometer installation work demonstrated that the reservoir may contain free liquids, in both aqueous and nonaqueous phases (see Figure 3.4

and Table 3.1). In some locations the liquids appear to be perched on top of the waste materials, and at other locations the liquids appear to extend near to the bottom of the reservoir. Distribution of the liquids appears to reflect the manner in which wastes were disposed of in the reservoir. Waste disposal occurred over several years, apparently in batches of varying materials. Some of the materials appear to be drilling muds, whereas other materials appear to be construction debris. Some materials appeared to contain oil. Observed liquid levels are not indicative of the actual level found within the reservoir nor the volume of liquids. The results of this investigation indicated that liquids are probably associated with thin seams and discrete zones of limited permeability within the wastes. Although perched liquids were encountered at some locations, liquids were observed throughout the waste mass.

3.2.4 HIGH VACUUM EXTRACTION

1. ERTC/REAC conducted two vacuum-enhanced extraction tests as a possible method for extracting reservoir liquids (ERTC, 1999c). This technology was believed by ERTC/REAC to be potentially applicable to the Site because of site conditions (e.g., methane and hydrocarbons detected in reservoir wells). ERTC/REAC performed the test using extraction wells (EX) EX-1 and EX-2. The wells were installed by WDIG for TM No. 6 and 8 field activities.
2. The objective of the tests were as follows:
 - Evaluate the effectiveness of vacuum-enhanced extraction for redeveloping EX-1.
 - Compare the effectiveness of this technology to standard pumping.
3. ERTC/REAC's principal conclusions drawn from this pilot test are as follows:
 - The objective of developing EX-1 as a free flowing well was not achieved; however, the test did demonstrate that fluid could be drawn into the well under vacuum and that it would return to the formation when the vacuum was released. This confirms the screen and gravel pack were not impeding flow.
 - The sustained rate of liquid extraction achieved from extraction well EX-2 averaged 4.93 gallons/hr during the first 5 days and 2.42 gallon/hr during the next 11 days. This compares to a yield of 3 gallon/hr as obtained by the WDIG using a 24-hour short-term cycle pumping test. Considering that the reservoir contains a fixed volume of fluid and the limited zone of influence, the yield is expected to decrease as liquid is removed by each test. Applying the vacuum appears to enhance the rate of liquid recovery and may increase the total volume recovered from a given well.

- The yield of combustible vapors was substantially less than the fuel requirement of the engine. The highest yield over a 24-hour period was 50,415 BTU/hr compared to a fuel demand of 360,000 BTU/hr. Also, there were extended periods with no measurable fuel being extracted. The rate of biologically produced methane from this site is substantially less than the unit consumes.
- The influence of the vacuum on liquid levels in the surrounding monitoring wells and piezometers displayed anisotropic conditions with no consistent correlation of drawdown versus distance.
- This technology is not cost effective for recovering energy or liquids from the reservoir. The poor performance is because of the limited rate at which methane is generated and the low permeability of the material.

3.3 SOIL GAS

1. The purpose of CDM Federal's soil gas investigation was to help support EPA's evaluation of the RD for the Site under the Subsurface Gas Contingency Plan (EPA, 1997c). Therefore, additional data were collected in order to provide a more comprehensive characterization of the current soil gas conditions. In-business air data were also collected to evaluate whether soil gas is migrating into the buildings onsite creating an explosion (methane) or health hazard (VOCs). Specifically, data collected during this investigation were used to address the following objectives:
 - Identify locations within the site and along the boundaries of the site with elevated VOCs and methane concentrations in soil gas that may indicate the migration soil gas emanating from wastes disposed at the site.
 - Obtain current data documenting subsurface gas migration near and below buildings for EPA's use in communicating site conditions to building owners and occupants.
 - Correlate, where possible, soil gas data with indoor air data to determine if there is a link between subsurface gas migration and indoor air quality.
 - Provide a current database for all chemicals found at the site in order to evaluate the proposed subsurface soil gas remedies.
2. The Subsurface Gas Contingency Plan investigation involved the sampling of the existing soil vapor monitoring well network at the Site, installation and sampling of temporary soil gas monitoring probes, and collection of in-business air data for analysis of volatile COC for the Site.
3. EPA established, within the Contingency Plan, soil gas ITSLs based on EPA ambient air PRGs. ITSLs have been established for most site VOCs at concentrations protective of

human health as shown in Table 3.2. A comparison of the ITSLs with soil gas concentrations for VOCs and methane show that ITSLs have been exceeded at several locations at the site. VOCs were detected above soil gas ITSLs in 10 wells and 11 temporary probes. Methane was above the 5 percent ITSL in five vapor wells and 26 probes. A summary of the VOCs detected in soil gas and the locations of ITSL exceedances are presented in Table 3.3. The location of the existing vapor well network is provided in Figure 3.8.

4. Benzene was the VOC most frequently reported above its soil gas ITSL (nine probes/seven wells), followed by vinyl chloride (five probes/nine wells), chloroform (two probes/two wells), tetrachloroethene (PCE) (two probes, one well), and 1,2-dibromoethane (one probe/two wells). Vinyl chloride and benzene were the only VOCs detected above ITSLs in the vapor wells in both the September 1997 and August 1998 sampling events. The site boundary ITSL for PCE of 190 ppbv was exceeded at gas probe GP-31 (PCE = 532 ppbv). This is the only location ITSLs were exceeded along the site boundaries.
5. In order to determine whether methane or VOCs from soil gas have migrated into the buildings onsite, in-business air samples were collected inside the 24 occupied structures on the site. Methane was not detected above 50 ppm (0.005 percent) inside any of the buildings. More than 25 VOCs were detected above background concentrations in the in-business air samples. Benzene was the chemical detected above ITSLs most frequently. According to CDM Federal, the presence of benzene, toluene, and xylene may be because of the use of petroleum products such as gasoline or motor oil by the businesses onsite. Many businesses at the site repair automobiles and store gas cans within the buildings. The presence of TCE, PCE, and vinyl chloride in the buildings may be because of the use of solvents and manufacturing processes. Vinyl chloride was only detected once at the building at 12635 Los Nietos Road (Stansell Brothers). Vinyl chloride was not detected in the duplicate sample at this location.

3.3.1 SUPPLEMENTAL SUBSURFACE GAS INVESTIGATION

1. Site data collected by EPA under the Contingency Plan and by the WDIG in subsequent soil gas investigations identified elevated concentrations of soil gas COC, in excess of the interim threshold criteria, adjacent to some site buildings. In response to the decision criteria outlined in the Contingency Plan for exceedance of the interim threshold criteria, EPA

determined that near-building soil gas monitoring was warranted for all structures that bordered buried wastes. Based on the partial well network established by the WDIG, EPA determined that 10 building locations met the requirement for permanent monitoring points between the buried waste and the building. The location of these wells (e.g., VW-54 through VW-63) is shown in Figure 3.8. The specific objectives of the vapor well installation effort were as follows:

- Complete the near-building permanent soil gas monitoring well network.
 - Evaluate concentrations of COC in the vicinity of all buildings that bordered buried wastes.
 - Assess the potential for preferential gas migration pathways in the vicinity of buildings bordering buried wastes.
2. Four vapor well monitoring locations (VW-55, -57, -58 and -61) exceeded soil gas ITSL criteria for at least one COC. None of the other VOCs detected in the wells exceeded threshold levels. These wells have been sampled on a quarterly basis by WDIG for the COC as part of the routine quarterly soil gas monitoring plan.

3.4 GROUND WATER

1. CDM Federal performed an evaluation to review and assess the WDI ground water monitoring and source characterization data to update the conceptual model for the site and establish a framework for any future long-term ground water monitoring program (CDM, 1999d). The site data and information reviewed included:
- Ground water elevation and ground water sampling results from the 27 existing monitoring wells at the site as shown in Figure 3.9.
 - Waste source characterization data from soil boring investigations and soil gas sampling.
 - Offsite and regional ground water information.
2. The following conclusions were based on the results and evaluation of ground water and waste source characterization and monitoring completed at WDI during the period October 1988 through April 1998 by CDM Federal:
- 1997 water level monitoring indicates ground water occurs at depths ranging from 30 to 48 feet bgs (approximately 22 feet below the base elevation of the buried concrete reservoir). The upper water-bearing zone (estimated to be 100 feet or greater in thickness) consists primarily of interbedded and interconnected sandy alluvial deposits without laterally extensive confining beds. The overall direction of ground water flow is towards the south-southeast with a very low horizontal hydraulic gradient (average 0.004 feet/foot).

- The Site contains a variety of liquid and solid wastes, many of which are hazardous substances, including petroleum and petroleum-related chemicals, solvents, acetylene sludge, drilling muds, and construction debris (WDI wastes). WDI wastes occur both within and outside of the buried concrete reservoir that was originally used for petroleum storage. Outside of the reservoir, WDI wastes were disposed in unlined excavated sumps and waste pits. Soil boring investigations have confirmed that the interval of buried sump wastes occurs over areas outside of the concrete reservoir (depths generally between 5 and 25 feet bgs).
- Primary contaminants at the Site which have the potential to cause ground water impact include the wastes buried within the concrete reservoir, the buried waste materials disposed outside of the reservoir, and the soil gas. Hazardous constituents detected in WDI waste include benzene, toluene, ethylbenzene, and xylene (BTEX); solvents, primarily TCE, PCE, and associated degradation products (e.g., vinyl chloride); SVOCs; heavy metals (arsenic, chromium, copper, lead), and PCBs. Elevated levels of soil gas are present in the subsurface (vadose zone) outside of the reservoir in many areas of the site. Soil gas hot spots are characterized by elevated levels of BTEX, methane, and petroleum hydrocarbon vapor, and chlorinated VOCs.
- Primary VOCs detected in ground water samples are TCE and PCE, generally at concentrations less than 10 micrograms per liter ($\mu\text{g/L}$). During 1997-98 sampling, PCE was detected at five monitoring wells at concentrations above its MCL of 5 $\mu\text{g/L}$ (maximum 77 $\mu\text{g/L}$, well GW-11). TCE was detected in ground water above its MCL of 5 $\mu\text{g/L}$ during 1998 sampling at one monitoring well (GW-11, 7.6 $\mu\text{g/L}$). PCE and TCE have only been detected in the western part of the site in both upgradient and deep monitoring wells. Based on ground water flow conditions, the distribution of detections and information on offsite ground water contamination sites, the source of the PCE and TCE detected in the monitoring wells in the western portion of the Site appears to be from solvent releases associated with upgradient chemical or industrial sites.
- Toluene has been detected sporadically in ground water sampled at monitoring wells adjacent to and downgradient of WDI sources (maximum concentration 64 $\mu\text{g/L}$ which is below the MCL for toluene). Toluene is considered a useful indicator chemical for ground water monitoring based on the solubility characteristics of this compound and the fact that it is also present in WDI buried waste and soil gas.
- There appears to be no light nonaqueous phase liquid (LNAPL) or dense nonaqueous phase liquid (DNAPL) sources contributing to ground water contamination beneath the site since high concentrations (i.e., greater than 1,000 $\mu\text{g/L}$) of dissolved solvents or BTEX and evidence of oily sheen or floating hydrocarbons have not been observed in any of the ground water sampling conducted at the Site.
- Ground water sampling at the Site has not shown a consistent distribution or detection of the primary metals (arsenic, chromium, copper, lead) which are present at elevated concentrations in WDI wastes. Concentrations of these metals are generally very low and only isolated sampling rounds have exceeded the MCLs. Evidence of

migration or impact to ground water from metals in WDI waste has not been observed in the ground water sampling data.

- Elevated concentrations of aluminum, iron, manganese, and selenium have been detected in ground water samples, in local cases, above primary or secondary drinking water standards. The fact that these metals are detected uniformly across the site (locally at higher concentrations in upgradient wells) suggests that the elevated concentrations reflect a regional water quality condition and are not related to WDI onsite sources.
3. No significant impacts from WDI wastes on ground water quality have been identified based on the available ground water sampling results and the comparison of sampling results with the location and characteristics of the waste sources at the site. Several site COC (VOCs and metals) have been detected above their respective State drinking water MCLs in ground water samples. However, these exceedances do not appear to be related to site wastes based on their distribution in ground water (i.e., some contaminants are detected upgradient or laterally away from WDI waste sources).

4.0 1997-1999 WDIG RD INVESTIGATIVE ACTIVITIES

1. This chapter presents results of the various supplemental site investigative activities conducted by the WDIG, under the 1997 RD Investigative Activities Workplan, as ordered by the Amended Administrative Order, Docket No. 97-09. The supplemental site investigative activities reported herein are listed below:

- Geoprobe investigation of soil conditions.
- Vapor well monitoring.
- In-business air monitoring.
- Ground water monitoring.
- Reservoir liquids monitoring and extraction testing.
- Reservoir trenching.
- Stormwater monitoring.

The investigative results are presented by site media (i.e., soils and perched liquids, soil gas, in-business air and ground water). The information summarized below was compiled from the following reports:

- Technical Memorandum No. 7 - Vapor Well Construction Details, November 1997
- Technical Memoranda Nos. 6, 8 and 12 - Reservoir Liquids Testing Report of Findings, October 1998.
- Technical Memorandum No. 9A - Soil Vapor Extraction Testing, Report of Findings, March 1999.
- Technical Memorandum No. 10 - Additional Soil Sampling and Leachability Testing Report of Findings, October 1998.
- Technical Memorandum No. 11 - Reservoir Area Grading Plans and Waste/Debris Management As-Built report, December 1998.
- Phase II - Reservoir Interior Tests Trench Excavation, Report of Findings, October, 1998
- 1998 Annual Ground Water Monitoring Report, March 1999.
- 1998 Annual In-Business Air Monitoring Report, March 1999.
- 1998 Annual Soil Gas Monitoring Report, March 1999.

See Chapter 7.0 for a full bibliography.

4.1 SOILS AND PERCHED LIQUIDS

4.1.1 SOILS AND PERCHED LIQUIDS CHARACTERIZATION

1. A geoprobe investigation was completed at the Site by the WDIG in Fall 1997, following the RD Investigative Activities Workplan, Appendix C - Treatability Study (TRC, 1997a and various addenda). Objectives of this program for specific site areas included the following:
 - Area Inside of the Reservoir:
 - Determine chemical characteristics of the waste materials disposed in the reservoir, and the near surface fill material overlying the waste.

- Area Outside of the Reservoir:
 - Delineate the areal extent and thickness of sump-like materials below the existing surface of the fill soil. Sump-like materials generally have the appearance of low permeability drilling mud with evidence of petroleum hydrocarbons.
 - Determine chemical characteristics of:
 - The fill soil above the sump-like material.
 - The sump-like material.
 - The native soil beneath the sump-like material.
 - Analyze the chemistry of perched water observed at several areas with sump-like material.
2. Figure 4.1 shows the location of the geoprobe borings installed to satisfy the above objectives. Probes TS-1 through TS-153 were selected to supplement: (1) prior data discussed in Chapter 2.0, and; (2) soil gas probe information collected by EPA in the summer of 1997 presented in Chapter 3.0. Probes TS-124 through TS-149 were installed at locations selected to collect representative samples for chemical analysis and geotechnical (primarily permeability) testing. Figure 4.1 also summarizes the soil chemistry and sump-like material thickness data. Table 4.1 summarizes the geotechnical results. Figure 4.2 summarizes the chemical analyses for the perched water samples extracted from two geoprobe locations (TS-137 and TS-142). Finally, Table 4.2 provides total petroleum hydrocarbon (TPH) data for the various materials encountered.
3. Volume of waste material inside the central reservoir is calculated to be approximately 148,000 cubic yards (TRC, 1997a). The volume of sump-like material outside the reservoir is calculated to be approximately 211,000 cubic yards, broken down by Site Area (see Figure 4.1) as follows:

APPROXIMATE VOLUME OF SUMP-LIKE MATERIAL BY AREA

SITE AREA	APPROXIMATE VOLUME OF SUMP-LIKE MATERIAL (cubic yards)	AVERAGE THICKNESS OF SUMP-LIKE MATERIAL (feet)
1	1,100	1.5
2	165,000	12
3	None	---
4	23,000	12
5	10,500	10
6	None	---
7	8,600	12
8	7,300	3
TOTAL	215,500	---
Stained Soil in Area 1	2,500	5

4. The chemical profile of the waste material summarized in Figure 4.1 is shown in comparison with the ROD COC. The criteria used for most constituents is the cleanup criteria presented in the ROD. Exceptions include arsenic, beryllium and thallium, which are compared to their industrial PRGs. This difference in criteria is used because data from the 1988 RI work showed that background levels for arsenic, beryllium and thallium indicated concentrations higher than the original ROD cleanup standards. Additional discussion on arsenic, beryllium and thallium is presented in the 1995 WDIG Predesign Report.
5. PCE and vinyl chloride concentrations are also presented in Figure 4.1. These constituents have been observed in some of the 1989, 1997 and 1998 soil gas vapor investigations. A complete data set for the COC is presented in Appendices A through G previously submitted in April 1999. Appendix J contains an index to the CD-ROMs containing Appendices A through G.
6. Observations from soil chemistry data of the 1997 WDIG geoprobe investigation are the following (see Figure 4.1):
 - Area Inside the Reservoir:
 - Most constituents for the waste materials (deeper samples at TS-130, -134, -135 and -140) are below cleanup standards. Exceptions are one exceedance of arsenic at a 12-foot depth in TS-135 single exceedances of chromium and PCE at 12-foot depth in TS-130.
 - Constituents for the overlying fill material generally are less than the cleanup criteria. Concentrations of arsenic and chromium at a depth of 3.8 feet in TS-130 are slightly above (30 percent and 32 percent) the cleanup standards. The concentration of arsenic at a depth of 3.3 feet in TS-140 exceeds the cleanup criteria by approximately 10 percent.
 - Area Outside of the Reservoir:
 - Sump-like material was observed throughout Area 2, along the inside perimeters of Areas 1 and 8 and within the interior perimeters of Areas 4, 5 and 7.
 - Thickness of sump-like material is approximately 3 to 12 foot. Some thicker zones exist in Areas 4 and 5. The Area 4 data correlates well with boring data from the 1995 Predesign investigation discussed in Section 2.3.1.
 - Soil Chemistry Data Results:
 - Overlying Fill:
 - Concentrations of Organic Constituents are below PRGs, at all locations.
 - Concentrations of metals are generally below PRGs, with the exception of:

- One occurrence of arsenic and chromium at TS-132.
- Occurrence of lead at TS-126, 129 and 132.
- Sump-Like Materials:
 - Concentrations of organic constituents are below PRGs at all sample locations.
 - Concentrations of metals are generally below PRGs, with the exception of arsenic, chromium and lead at TS-132.
 - Constituents appear relatively nonleachable.
- Underlying Soils:
 - Concentrations of metals and organics below PRGs for practically all underlying soil samples. The only exception is one occurrence of arsenic at 20 percent above the PRG at a depth of 18 feet in TS-138.
- Chemistry of Perched Water Observations (see Figure 4.2):
 - Perched water was sampled and analyzed for VOCs at TS-137 and -141. Additional analysis were not performed due to a limited volume of sample collected. Analyses of the water from these locations show no detectable concentrations of VOCs. A more comprehensive Treatability Study (TM No. 13) is currently ongoing, generating additional data on perched reservoir liquids at the Site. Results of the study will be incorporated as part of the Remedial Design.

7. As indicated above, the soils and sump-like materials are generally below hazardous waste criteria. Several outliers of relatively low metals exceedances were observed, primarily in overlying fill soils. Toxicity Characteristics Leaching Procedures (TCLP) testing of selected soil samples is presented in Section 4.1.2.

8. Table 4.1 shows that the fluid conductivities of the subsurface materials vary as follows:

<u>Material</u>	<u>Liquid Hydraulic Conductivity (cm/sec)</u>	<u>Air Conductivity (cm/sec)</u>
• Overlying Fill	10^{-7}	10^{-6} to 10^{-9}
• Sump-like Material	10^{-4} to 10^{-7}	10^{-6} to 10^{-9}
• Underlying Soil (Native)	10^{-3} to 10^{-6}	10^{-4} to 10^{-8}

The most important observations from these data are: (1) the generally low hydraulic; and (2) air conductivities of the sump-like materials and existing fill "cap" soils. These characteristics are similar to those frequently required for a low permeability cap and will greatly reduce the potential for significant infiltration water or gas migration to occur.

9. In summary, sump-like materials are located over most of Areas 2, 4 and 5 and portions of Areas 1, 7, and 8. These materials range in thickness from very thin to approximately 18 feet. Chemical profiles for these materials generally show conditions which are below cleanup criteria. In addition, the material has a very low hydraulic conductivity which restricts migration of either infiltrating water or subsurface gases. The material appears to be relatively nonleachable and impermeable. Additional discussion of the leachability of these materials is presented below.

4.1.2 ADDITIONAL SOIL SAMPLING AND LEACHABILITY TESTING

1. A field investigation (TM No. 10 - Additional Soil Sampling and Leachability Testing) (TRC, 1998d) was conducted to determine the potential leachability of site COC, for use in evaluating the range of remedial alternatives options for areas outside the reservoir as part of the FS process. A limited number of samples (10 total) were collected from five locations at the Site. Samples of the fill and waste material were collected from each location. Refer to Figure 4.3 for TM No. 10 testing locations.
2. The following activities were conducted according to the Scope of Work outlined in TM No. 10:
 - Collect and analyze fill and waste material samples from five locations onsite reservoir and outside.
 - Analyze the samples by TCLP and Soluble Threshold Limit Concentration (STLC) methods.
 - Provide data to compare the characteristics of materials from inside and outside the reservoir.

4.1.2.1 Sampling Procedures and Chemical Analysis

1. Fill and waste material samples were collected from the areas shown in Figure 4.3, using procedures outlined in TM No. 10.
2. Samples collected for total volatiles analysis (EPA Method 8260A) and TCLP testing were collected using an EMCOM sampler following EPA Method 5035. The TCLP samples were extracted with acetic acid or with deionized (DI) water at the laboratory using EPA Method 1311 procedures. The DI water extract was run for a 48-hour period to simulate rain infiltration and analyzed using the methods listed below:
 - EPA Method 8260 (Volatile Organics)
 - EPA Method 8270 (Semivolatile Organics)

- EPA Method 8081 (Pesticides and PCBs)
 - EPA Method 6010A, 7060, 7421, 7470 and 7740 for metals
3. In addition, a set of the samples extracted using the California CAM-WET Test and analyzed for the constituents listed above with STLC values.

4.1.2.2 Summary of Analytical Results

1. Based on the total VOC data, the following conclusions can be made:
 - Fill Samples (WDI-LS-1 through WDI-LS-5):
 - VOCs would be below TCLP and MCL limits.
 - Waste Samples (WDI-LS-1 and WDI-LS-2):
 - VOCs would be below TCLP limits.
 - Waste Samples (WDI-LS-3, WDI-LS-4 and WDI-LS-5):
 - VOCs would be below TCLP limits for all the constituents with the exception of vinyl chloride in sample WDI-LS-3. Sample WDI-LS-3 had a high detection limit (1 to 2 milligrams per kilogram [mg/kg]) for vinyl chloride; however, the result does not necessarily mean that vinyl chloride is present.
2. Table 4.3 provides a summary of the TCLP and STLC testing results. Based on the TCLP results, there were no samples with detectable levels which exceed the regulatory limits.
3. The California CAM-WET Test, also known as the STLC Test, is generally considered to be more aggressive than the Federal TCLP Test. The STLC analysis focuses on metals, one VOC (TCE) and pesticides/PCBs. Table 4.3 provides a summary of the STLC data. As indicated in Table 4.3, one exceedance of the STLC for lead was observed, in sample WDI-LS-4 (fill). The sample contained 5.07 mg/L lead compared to the STLC limit of 5.0 mg/L. This exceedance is not considered significant, since the average of the results is well below the 5.0 mg/L standard.
4. To determine the potential for leaching of constituents because of rainwater infiltration, samples were also extracted using DI water for 48 hours, in comparison to the standard 18-hour TCLP extraction procedure. Results of this comparison indicated the following:
 - Use of DI water significantly reduces the amount of leachable constituents.
 - No exceedances of the TCLP criteria were observed.
 - DI water leached samples were below MCLs.

4.1.2.3 Findings

1. Based on the limited amount of data generated, it appears that the fill and waste materials are not considered hazardous by Federal TCLP or State STLC criteria. The only exception to this conclusion is vinyl chloride which had a significantly high detection limit in this testing episode which prohibited determination of the status of vinyl chloride. However, based on the other VOC levels, it is unlikely that vinyl chloride will exceed the TCLP limit. As discussed in Section 4.1.2.2, one minor STLC exceedance was observed for lead in Sample WDI-LS-5 (fill). This exceedance is not considered significant since the average soluble lead level was well below the 5.0 mg/L criteria.
2. Because of some of the high detection limits observed during this test, a full evaluation of the potential leaching constituents above the MCLs for drinking water could not be completed. Elevated detection limits occurred because of the presence of oily hydrocarbons in the sump-like materials.
3. Evaluation of the deionized leaching results confirmed that the potential for leaching under rain infiltration conditions is very low, and well below the TCLP acid extraction levels. This indicates that it is unlikely that significant leaching has occurred in the past, which is supported by quarterly ground water data collected at the Site.
4. Based on the information presented above, the Site materials tested can be classified as nonhazardous for disposal purposes.

4.2 RESERVOIR LIQUIDS

4.2.1 INITIAL RESERVOIR LIQUIDS INVESTIGATION

1. Figure 4.4 shows the location of Well VW-09, from which reservoir liquids samples were collected and analyzed in October 1997. The figure also summarizes the chemical profile of the sampled reservoir liquids.
2. In October 1997, VW-09 was sampled for liquids and evacuated to determine its recharge potential. Sampling of VW-09 liquids indicated the following constituents:
 - VOCs
 - Benzene, toluene, and vinyl chloride (e.g., 760 µg/L, 1,400 µg/L, 11.0 µg/L respectively).

- SVOCs
 - Naphthalene and 2-methylnaphthalene (e.g., 690 µg/L and 890 µg/L).
- PCBs (not shown on figure)
 - Low levels of PCBs were detected, e.g., <0.5 ppm.
- Metals
 - Low levels of Arsenic, Barium, Cadmium, Chromium, Lead and Nickel were detected (e.g., 0.19 µg/L, 0.41, 0.011, 0.025 and 0.094 µg/L respectively).

Monitoring of well recovery indicated the well recharged to within 80 percent of the original level within 24 hours. No additional liquids related activities were conducted until the beginning of TM Nos. 6 and 8. The VW-09 data is included in Appendix K. Those activities are reported in Section 4.2.2.1.3 (TM Nos. 6 and 8 Findings).

4.2.2 ADDITIONAL RESERVOIR LIQUIDS INVESTIGATIONS

4.2.2.1 TM Nos. 6, 8 and 12 - Reservoir Liquids Testing

1. The purpose of TM Nos. 6, 8 and 12 activities was to assist in determining the hydraulic yield potential and chemical characterization of the liquids (free and aqueous phase) within the buried reservoir at the Site. Specific objectives for this investigation were as follows:
 - Estimate the hydraulic yield of the saturated portion of the reservoir and extraction well radius of influence.
 - Delineate chemical and physical characteristics of both free and aqueous phases of encountered reservoir liquids.
 - Characterize chemistry of soil gas from evacuated portion of saturated reservoir material, if possible.
2. Results of the initial TM No. 6 activities indicated the liquids extracted during the pump test were being yielded by the overlying fill soils and not the underlying, relatively impermeable waste material. As indicated in Section 4.1.1, fluid conductivity testing indicated the hydraulic conductivity in the fill is on the order of 10^{-7} (cm/sec). Although the conductivity appears low in comparison to the TM No. 6 results, it appears that the majority of the flow comes from between the fill and sump layers. To help verify this hypothesis two additional pump tests were performed, as indicated in the TM Nos. 6, 8 and 12 Report of Findings (TRC, 1998b).
3. Liquids recovery tests using reservoir piezometers were also performed under TM No. 12. The tests consisted of purging 62 1-inch piezometers installed by EPA in July 1998, as

discussed in Section 3.2.3, and monitoring the liquid recovery rates. The data collected during the TM No. 12 recovery testing was used for the following:

- Characterize the recharge rates of the reservoir liquids.
- Determine if liquid levels return to initial static levels.

4.2.2.1.1 Field Activities

1. This section summarizes the reservoir liquids investigations completed as outlined in TM Nos. 6, 8 and 12. This section also describes how these activities were implemented and discusses changes to the planned Scope of Work that occurred because of encountered field conditions and observations.
2. The Scope of Work for TM No. 6 activities included the following list of tasks:
 - Installation of six extraction wells and 16 monitoring probes.
 - Monitoring of baseline conditions of the liquids in the buried reservoir in the newly installed wells and probes.
 - Performance of a series of step and cycle-pump tests on the extraction wells.
 - Monitoring of free and aqueous phase recovery rates.
 - Sampling of free and aqueous phase liquids in the extraction wells and monitoring probes.
 - Sampling of soil gas in extraction well WDI-EX-2 (EX-2).
 - Liquids sampling at other wells located within the reservoir.
3. The installation of WDI-EX-1 (EX-1) and monitoring probes WDI-P-1, -2, -3 and -4 was completed on December 11 and 12, 1997. Refer to Figure 4.5 for the location of the extraction wells and monitoring probes. The wells and probes were constructed to the bottom of the reservoir, approximately 22 to 24 feet in depth, with screened intervals extending through the fill and waste materials. Figures 4.6 and 4.7 illustrate the subsurface encountered during the well and probe installations.
4. The stratigraphy of the reservoir materials was found to be relatively consistent. A silty sand to sandy silt fill soil layer of approximately 9 to 10 feet thick occurs over an approximately 15-foot layer of black stained clays (drilling muds). Initial monitoring of liquid levels indicated that EX-1 was essentially dry, although the monitoring probes each contained liquids at a consistent elevation. Free product of varying thicknesses (0.4 to 7.25 feet) was detected at each monitoring probe.

5. Because of the conditions of EX-1 (i.e., dry well), an addendum to TM No. 6 was submitted. EX-2 was installed approximately 8 feet to the east of EX-1 and constructed similarly. Liquids were observed in EX-2 at approximately 4.5 feet bgs prior to initiating pump tests. Stepped pump tests were performed at EX-2 (0.5 gallons per minute [gpm] and 0.25 gpm).
6. EX-2 was dewatered to the pump inlet in 3 hours and 19 minutes during the 0.5 gpm pump test (see Figure 4.8 for liquid drawdown data). Approximately 93 gallons of liquids were purged from the extraction well during the test. Results from the 0.5 gpm test indicated a low yield from the reservoir material. Following consultation with EPA, a decision was made to reduce the pump rate to 0.25 gpm.
7. EX-2 dewatered in approximately five hours and five minutes during the 0.25 gpm. Approximately 232 gallons of liquids were extracted during this test. At the completion of this time, and after a consultation with EPA, it was decided to complete a series of pump cycle tests over a 24-hour period to establish if a sustainable liquid extraction rate could be achieved. At full capacity the pump dewatered the wells in approximately two to three minutes. The recharge into the well ranged from 6 to 8 feet (see Figure 4.9 for liquid drawdown data). The pump was cycled on at approximately two to four hour intervals.
8. The approximate radius of influence and liquid drawdown conditions from pumping EX-2 are shown in Figures 4.10 and 4.11. Approximately 325 gallons were extracted from EX-2 during the pump tests performed by WDIG. ERT extracted approximately 1,413 gallons from EX-2 during high volume testing performed June 25 through 29, 1998 (see Section 3.24). Following the completion of the pump test activities, liquid levels appeared to have recovered to essentially the prepumping levels.
9. Free and aqueous phase liquids were sampled and analyzed from EX-2 and monitoring probes prior to the 0.5 gpm pump test. EX-2, P-1 and VW-09 were also sampled at the conclusion of the 0.25 gpm pump test since only these wells showed an influence (liquid level drop) during the test. Additional wells within the reservoir boundaries were also sampled for liquid characterization. Analytical results are summarized on Table 4.4.
10. A soil gas sample was collected from EX-2 on June 11, 1998 after the well was drawn down. The analytical results of the VOCs detected in the soil gas samples include vinyl chloride, benzene, TCE, toluene and xylene. These results shown above (TRC, 1998b) are higher than previous vapor well monitoring results from within the reservoir area. This is because of the

pumping activity which can increase the volatilization of organics from liquids during drawdown and recovery, which allows the liquids to volatilize into the fill the pore space.

11. Microbial analysis of the extraction liquids indicates the presence of aerobic and anaerobic bacteria in the samples, as shown in Table 4.5. In general, the microbial levels were relatively low (i.e., less than 1,000,000 organisms/L), with the exception of WDI-NDP-3 (EX-4 monitoring probe) which had 2,400,000 and 2,900,000, anaerobic and aerobic organisms/L, respectively. It was anticipated that the anaerobic bacteria levels would likely be in the range of 10 to 100 million organisms per liter given the anaerobic nature of the liquids. The lower than expected anaerobic bacterial levels are consistent with the observed low methane generation rates.
12. Samples of the oily liquids from the pump testing were also analyzed to determine the British Thermal Units (BTU) and sulfur contents to evaluate the potential for these materials to be used as an alternative fuel material, or blended with a fuel source for use in an industrial type boiler or incineration. Oily materials with a BTU over 12,000 may have the potential for use in fuels or fuel blend. Sulfur contents greater than one percent generally reduce the feasibility of use as a fuel. As shown in Table 4.5, several of the well samples exceed the 12,000 BTU level and therefore could be considered for use in fuels. The sulfur contents of the samples all appear well below the 1 percent level, which could allow their use as a fuel if disposal is required. It must be considered that the oily portion of the liquids is only a small amount of the overall liquids in the reservoir, and therefore use as an alternate fuel may not be practical.
13. Liquid levels were monitored in the reservoir from November 1997 to February 1998. During this period, liquid levels rose significantly because of unprecedented rainfall caused by the global weather pattern known as "El Niño" (see Figure 4.12). There is an anomalous drop in water level at Well P-1, the reason is not apparent.

4.2.2.1.2 Pump Testing at EX-4 and EX-6

1. Although it was initially hypothesized that the reservoir liquids were being extracted from overlying fill materials, it appears that the reservoir is behaving in a noncontinuous fashion. There appears to be higher permeability lenses which are filled with liquids, with little interconnection, and in varying directions. However, to attempt to verify the initial

hypothesis, an addendum to TM No. 6, Addendum-TM No. 6 Additional Extraction Wells and Pump Tests, was implemented. The scope of the additional field investigative activities included the following:

- Installation of four liquid extraction wells (EX-3, -4, -5 and -6) at locations in the reservoir determined in conjunction with EPA's reservoir boring investigation results and 12 associated monitoring probes (see Figure 4.5).
 - Pump cycle tests were performed in the new extraction wells, with associated monitoring in the adjacent well(s) and probes.
 - Liquid samples were collected from the new wells for chemical characterization.
2. The installation of extraction wells EX-3 through -6 and monitoring probes (NSP-1, -2, -3; NDP-1, -2, -3; SSP-1, -2, -3; SDP-1, -2, -3) were similar to other TM No. 6 wells constructions.
 3. The stratigraphy of the reservoir materials was consistent with previous TM No. 6 activities (see Figures 4.13 to 4.16).
 4. Liquid level measurements for each extraction well and monitoring probe were recorded prior to initiating the pump tests. Results showed similar levels as EX-2 and P-1 through -4 wells with the exception of the shallow extraction wells (EX-3 and EX-5), which were dry.
 5. EX-4 was dewatered to the pump inlet level in approximately 10 minutes. The extraction well recovered to the pump level switch after 4.5 days. A complete series of two pump cycle tests were performed over an 18-day period to establish if a sustainable liquid extraction rate could be achieved. A total of approximately 42 gallons of liquids were extracted from EX-4 during this time. Refer to Figure 4.17 for EX-4 pump test recovery data.
 6. EX-6 also dewatered in approximately 10 minutes. A complete series of 10 pump cycle tests was performed over a 14-day period to establish if a sustainable liquid extraction rate could be achieved. A total of approximately 139 gallons of liquids were extracted during this test. Refer to Figure 4.18 for EX-6 pump test recovery data.
 7. There did not appear to be a radius of influence during the pumping from EX-4 and -6, based on the lack of response in the associated piezometers, possibly because of a higher permeability lens bounded by a less permeable material.

8. A total of approximately 180 gallons were extracted from EX-4 and -6 during the pump tests and stored separately from EX-2 purged liquids. These liquids were sampled and handled similar to EX-2 purged liquids. Following the completion of the pump test activities, liquid levels appeared to have recovered to essentially the prepumping levels.

4.2.2.1.3 TM Nos. 6 and 8 Findings

1. The liquid measurements for the extraction wells (EX-1 through EX-6) and monitoring probes demonstrated a tremendous variability of the liquid content and permeability characteristics of the solid materials encountered within the reservoir.
2. The presence and thickness of the floating free product also varied in the wells. EX-2 did not encounter free product initially; however, a small quantity of product was induced into the well following repeated pumping. EX-4 did not encounter free product during the duration of the pump test activities. Some of the monitoring probes had measurable layers of floating product, ranging from 0.52 inches to 7.27 feet. The free product thickness also varied over time within individual probes, with product thickness ranges in some individual probes as high as 4.77 feet. Table 4.6 shows the liquid levels and the thickness of free product during TM No. 6 activities.
3. The results of the pump tests showed that the reservoir liquids have a relatively low hydraulic yield. The short-term cycle pump tests yielded the following:

PUMP TEST LOCATION	APPROXIMATE AVERAGE YIELD (gpm)
EX-2	0.050
EX-4	0.001
EX-6	0.020

Table 4.7 summarizes the hydraulic yields of the material for the pump tests at EX-2, -4 and -6.

4. Review of the drawdown data from the monitoring probes indicates that the radius of influence from well EX-2 ranges from less than 5 to approximately 20 feet. The following table summarizes the greatest drawdown measured in each probe.

<u>Monitoring Well</u>	<u>Distance from EX-2</u>	<u>Direction from EX-2</u>	<u>Maximum Drawdown (ft)</u>
P-1	5	North	0.85
VW-09	15	South	3.5
P-2	23	East	--
P-3	26	West	--
P-4	45	East	0.41

Although P-4 was observed to have an influence of drawdown at 45 feet away from EX-2, P-2 is located directly between the two wells (see Figure 4.5 for the location of the well extraction and probes). Discontinuity in the influence sphere is possibly the result of the orientation higher permeability zones or lenses. However, during ERTC/REAC liquids investigations at EX-2, a limited drawdown in liquid levels was observed at P-2 and P-3.

5. Review of the drawdown data from the monitoring probes during EX-4 and EX-6 pump test did not appear to show an influence directly related to pumping. However, there did appear to be minor fluctuations in elevations ranging from 0.1 feet to 0.3 feet. These fluctuations may be part of naturally occurring phenomena (i.e., possibly influenced by changes in barometric pressure) which have been observed throughout TM No. 6 activities.
6. The results of the chemical analyses of the encountered liquids generally indicate conditions that would be expected given the known history of waste deposition at the Site. The analyses confirm that the waste material is primarily drilling muds containing petroleum hydrocarbons, although some other materials may have been disposed at the Site. Analysis of the reservoir liquids indicates they are not considered a hazardous waste. However, one well, P-3, showed high PCB levels when sampled by EPA. Subsequent samples were collected by WDIG, and the PCB levels were below the nonhazardous criteria. Tables 4.8, 4.8A and 4.9 summarize the chemical characteristics of the liquids encountered.
7. Soil gas sampling of EX-2 indicated elevated levels of cis-1,2-dichloroethene, benzene, toluene and total xylenes at concentrations of 34, 15, 11, 15 and 7.9 ppm respectively. The gases may be from the surrounding soil column since the well was screened from 5 to 22 feet. Some of the VOCs may have volatilized from the liquids (LNAPL) and therefore are not expected to be representative of the true soil gas conditions in the reservoir.

4.2.2.2 TM No. 12 Activities

1. Liquid recovery testing of the piezometers was initiated on October 1, 1998. Prior to purging, liquid levels were monitored using a water/oil interface probe (see Table 4.10 for monitoring results). Purging activities were conducted by using a peristaltic pump and placing tygon tubing to the bottom of the piezometer. The piezometers were purged at a rate of approximately 0.15 gpm until the piezometer was dewatered or a minimum of one well volume (approximately one gallon) was purged. The liquid levels were monitored initially, one hour and 24 hours after purging.
2. Observations made during TM No. 12 activities also show the tremendous variability of the liquids and material characteristics encountered within the reservoir boundary. This is supported by the drawdown depths, recovery rates and levels recorded during field activities.
3. Prior to purging, the presence and thickness of the floating free product varied in all the wells ranging from a sheen on the surface to approximately 5.25 feet thick.
4. Drawdown levels measured immediately after pumping activities have shown an influence ranging from no drawdown to purging the piezometer dry (see Table 4.10 for liquid levels).
5. Recovery of the liquids were monitored initially, one hour and 24 hours following purging activities. In some of the piezometers, liquid levels recovered back to and even greater than the original level (i.e., prior to purging). In others, parameters did not recover back to original levels. The following is a summary of the results:

NO. OF PIEZOMETERS	FINAL LIQUID LEVEL CONDITION
4	> Prepurge Level
28	< Prepurge Level
30	= Prepurge Level

Table 4.10 summarizes the liquid levels monitored during field activities.

6. Approximately 65 gallons of liquids were purged during the field activities. The purged liquids were discharged into two 55-gallon drums. Disposal of these liquids was handled during TM No. 11 - Reservoir Grading and Waste/Debris Management activities.

7. At the completion of the recovery monitoring, the piezometers were abandoned by pulling the PVC out of the ground, cutting off the top 4 feet, pushing the PVC back into the ground and then pressure grouting the casing.

4.2.2.2.1 TM No. 6, 8 and 12 Conclusions

1. In order to further investigate the reservoir liquids and materials characteristics, WDIG performed several pump test activities within the reservoir boundary. WDIG's findings indicate that there is a tremendous variability in the liquids and materials characteristics within the reservoir. This is also demonstrated by the data collected during EPA and WDIG trenching activities (see Section 3.2).
2. Observations and analytical data collected during trenching and TM Nos. 6, 8 and 12 activities showed the following characteristics of the materials encountered within the reservoir:
 - Reservoir liquids appear to consist of infiltrated rainwater and light crude oil, based on the observed characteristics and the analytical data.
 - Fill material consists of a heterogeneous silty sand to sandy silt layer intermixed with wood and concrete debris.
 - Waste material consists of black stained clays (drilling muds) with zones of liquid and/or free product.
 - Hydraulic characteristics of liquids within reservoir boundary are heterogeneous. Areas of higher permeability lenses which contain liquids were observed in both the fill and sump material.
 - Chemical characteristics of liquids do not indicate the liquids are a hazardous material.
3. Observations made during the TM Nos. 6 and 12 activities support the hypothesis that liquids within the fill and sump material are contained within higher permeability lenses. These pockets are not interconnected and locations are not well defined throughout the reservoir.
4. A total of 22 wells were installed by WDIG to demonstrate whether the liquids in the reservoir could be effectively extracted by pumping activities. The data generated from these wells indicated the following:
 - Three of the six extraction wells were dry (EX-1, -3 and -5). This is possibly because of the undefined areas of higher permeable lenses.
 - Liquid levels appear to be related to the diameter of the wells (see Figure 4.19 for liquid level differences). The levels are influenced by: (1) low permeability of the fill and waste material; (2) limited volume of liquids; and (3) differences in void space determined by the diameter of the boring.

- Low hydraulic yields of the material. Sustainable short-term yields ranged from 0.001 gpm to 0.050 gpm. The yields would be expected to decrease over time because of the limited zone of influence and volume of free-liquids contained in the higher permeability lenses.
- Limited radius of influence ranging from less than 5 feet to approximately 20 feet during WDIG activities. However, during ERT's vacuum enhanced testing, an influence was observed >20 feet from the extraction well.

4.2.3 PHASE II RESERVOIR INTERIOR TEST TRENCH EXCAVATION

4.2.3.1 Introduction

1. The purpose of these activities was to assist in determining the location of liquids (free and aqueous phase) within the buried reservoir at the Site. The specific objectives for each of these activities were as follows:
 - Observe the liquid conditions in the fill and waste material.
 - Measure the release rates of the liquids encountered in the test trench.
 - Measure the change in liquid levels and quantities over time.
 - Observe the physical behavior of the waste material.
 - Measure the production values for the trench work.
2. The following activities were conducted according to the scope of work:
 - Excavation of three test trenches.
 - Installation of two piezometers in two of the three test trenches.
 - Paint filter tests performed on subsurface samples collected during trenching.
 - Monitoring liquid levels in riser pipes.

4.2.3.2 Field Activities

1. This section summarizes the test trenching activities completed during September 1998. This section describes how these activities were implemented and discusses changes to the planned scope of work that occurred due to field conditions and observations (TRC, 1998c). Appendix L contains the Phase II Reservoir Test Trenching Report of Findings.
2. The scope of work completed during trenching activities included the following sequence of events:
 - Excavated Test Trench II-1 in the central portion of the reservoir and installed one piezometer (TTII-1).
 - Excavated Test Trench II-2 in the northern portion (12:00 o'clock position) of the reservoir and installed one piezometer (TTII-2).

- Excavated Test Trench II-3 in the southern portion (6:00 o'clock position) of the reservoir.
 - Monitored liquid levels in the piezometers.
3. As tasks described in the Phase II Workplan were executed, some of the specifics were modified, with EPA concurrence, to suit field observations and conditions. The following paragraphs discuss each of the activities performed and field changes made.
 4. Excavation of three test trenches (Test Trench II-1, -2 and -3) was performed within the boundaries of the buried reservoir. The locations of the trenches are shown in Figure 4.20. Figures 4.21 through 4.23 illustrate the subsurface conditions encountered during the trenching activities and the construction details of the piezometers installed.
 5. Test Trench II-1 was excavated near existing reservoir liquids extraction wells and monitoring probes (i.e., EX-2, VW-09 and P-2) installed during TM No. 6 activities. This location was selected based on previous observations made during TM No. 6 field activities. This location was also selected because it could be assumed that most liquids would tend to migrate toward the central position of the reservoir. The trench was excavated using a track mounted excavator to approximately 20 feet in length, 4 ft in width and 20 feet in depth.
 6. Cuttings generated from Test Trench II-1 were separated into two separate stockpiles (fill and waste material) adjacent to the trench. The waste material was stockpiled on a plastic liner and sprayed with a vapor suppressant, BioSolve™, to help control vapors emanating from the trench and cuttings. The total depth of the trench extended to the bottom of the reservoir (approximately 20 feet). However, due to the characteristics of the waste material (soft, low shear strength), the trench walls collapsed to approximately 15 feet from the surface. Piezometer PII-1A was then installed at a total depth of 15 feet in the central portion of the trench to monitor the liquids zone encountered at 9.5 feet below ground surface (bgs) (see Figure 4.21). The pipe was screened from 10 to 15 feet and a gravel filter pack was placed to 9 feet bgs. The remaining portion of the trench was backfilled with the cuttings with 2 feet of clean fill overlying the waste material.
 7. Test Trench II-2 was located within the northern portion of the reservoir boundary, at approximately the same location as EPA's Trench-2. The location of Test Trench II-2 was chosen based on previous information observed during EPA's trenching (i.e., liquids encountered at approximately 9.5 feet bgs) and TM No. 6 piezometer data. The trench was excavated using the same procedures as described for Test Trench II-1. The trench dimensions

were approximately 22 feet in length, 8 feet in width and 15 feet in depth (see Figure 4.33). Similar conditions were encountered with the fill and waste material as Test Trench II-1 (i.e., characteristics of the material and the caving of the trench walls). A piezometer PII-2A was installed at a depth of 11.5 feet with 5 feet of screen.

8. The volume of gravel used to construct the piezometer in Test Trench II-2 displaced the volume of waste material generated from trenching, thus resulting in the waste material to be backfilled to the surface. Under the supervision of EPA, approximately 20 cubic yards (cy) of waste material was reexcavated and placed into a lined roll-off bin. The trench was then backfilled with 3 feet of fill above the waste material. The cuttings in the roll-off bin will be disposed during TM No. 11 Reservoir Grading and Waste/Debris Management field activities.
9. Test Trench II-3 was located at the southern portion of the reservoir boundary. This location was agreed upon by EPA and WDIG. The original proposed location was between the 1:00 and 2:00 position on the reservoir where liquids were encountered during EPA's trenching activities. However, due to time constraints and the lack of data in the southern portion, this location was selected. Test Trench II-3 was excavated to 30 feet in length, 4 feet in width and 20 feet in depth (see Figure 4.23). Caving of the waste material from the trench walls also occurred which prevented the trench from remaining open to the bottom of the reservoir. A piezometer was not constructed in this trench since the liquids characteristics were not similar (i.e., volume of liquids observed) to Test Trenches II-1 and -2.
10. Grab samples of each subsurface layer encountered were collected using the excavator bucket in each trench. Paint filter tests were then performed on these samples following EPA Method 9095.

4.2.3.3 Findings

1. The stratigraphy of the reservoir materials was relatively consistent in all three test trenches. A silty sand to sandy silt fill soil layer of approximately 8 to 10 feet thick lies over an approximately 15-foot layer of black stained clays which comprise the waste material. Test Trenches II-1 and -2 had an increase in the size and content of debris (i.e., broken concrete) compared to other investigative areas within the reservoir during Phase I and II field activities. The top 8 feet of fill material was dry and compacted in all three test trenches. Liquids were observed in Test Trenches II-1 and -2 at the transition zone of the fill and waste material (approximately 9.5 feet bgs). The findings in Test Trench II-2 were consistent with

EPA Phase I-Trenching. Test Trench II-3 did not encounter similar liquid conditions. The volume of liquids observed in Test Trench II-3 was minimal and did appear to warrant the construction of a piezometer.

2. Liquids encountered in Test Trenches II-1 and -2 flowed into the trenches at a constant rate of approximately less than 0.5 gpm for a limited period. The liquids appeared to be flowing from a perched zone located in the fill and waste material transition zone. Small seeps also appeared on the walls of the trench in the waste material, but were not generating a significant volume of liquid (i.e., pooling of liquids was not observed in the trenches).
3. Liquid level data collected for a pump test from nearby wells show a slight decrease in elevation (approximately 0.4 inches) following trenching activities at Test Trench II-2. This decrease in elevation may have been influenced by the trenching activities.
4. The presence and thickness of free product also varied in the trenches compared to existing monitoring wells. Floating free product was not encountered in the trenches. However, a sheen was observed on the water flowing into the trenches. Data collected from reservoir liquids extraction wells and monitoring probes, located approximately 5 to 10 feet from the trench, indicated a layer of floating product, ranging from 0.2 inches to 1.7 feet.
5. Liquid levels were monitored in piezometers TTII-1A and -2A, as well as existing nearby monitoring wells, and are shown in Table 4.11. The liquids measured in existing monitoring wells, located within 10 feet of the two trenches (i.e., EX-2, P-1, VW-09, DNP-1 and SNP-1), have liquid levels inconsistent with the levels observed in the trenches. The difference in liquid levels between the wells and the trenches is approximately 7 feet, while the largest difference between the wells is approximately 5 feet.
6. Paint filter test results from the three test trenches indicate that there were no "free liquids," as defined in Title 22 of CCR, in the fill or waste material. Table 4.12 presents the results for the paint filter test.
7. The following observations were made with respect to the composition and characteristics of the fill and waste material during excavation:
 - The fill material was compacted, and contained large pieces of debris (i.e., broken concrete) which made trenching difficult.

- The volume of material excavated from the trench increased as the debris was removed. The walls of the trench would begin to collapse making the work area unsafe.
 - The waste material was soft and saturated causing the walls of the trench to collapse. This also increased the volume of material excavated and slowed production of the trench.
8. Test Trenches II-1 and -3 were trenched to the bottom of the reservoir (~20 feet bgs). However, due to the conditions noted above (i.e., caving of trench walls), the trench (depths >15 feet below ground surface) did not remain open for a long period of time. It is important to note that liquids did not pool in the trench at depths >15 feet, including the trench completed to the bottom of the reservoir.
9. WDIG's findings indicated the following:
- Tremendous variability in the liquids characteristics within the reservoir.
 - Fill material consisted of a silty sand to sandy silt layer intermixed with wood and concrete debris.
 - Waste material consisted of black stained clays.
 - Hydraulic characteristics of liquids within reservoir boundary were heterogeneous.

4.3 SOIL GAS

4.3.1 ANNUAL SOIL GAS MONITORING RESULTS

4.3.1.1 Introduction and Purpose

1. An Annual Soil Gas Monitoring Report was submitted to EPA in March 1999 to provide a summary and evaluation of the soil gas data collected by the WDIG from February 1998 through October 1998 at the site (TRC, 1999a).
2. The current vapor well network is composed of the following well groups:
 - VW-01 through -26 installed by EPA in 1988 as part of the RI (EBASCO, 1989d).
 - VW-27 through -55 installed by WDIG in 1997 as part of TM No. 7, under the RD Investigation Alternative Workplan (TRC, 1998e).
 - VW-56 through -63 installed by EPA in 1998 as part of the Subsurface Gas Contingency Plan (EPA, 1997c).
3. The purpose of the annual report was to review the soil gas conditions observed and to evaluate potential offsite gas migration from WDI sources. The report was prepared with the following objectives:
 - Provide a summary of the soil gas data collected during 1998 by WDIG.

- Evaluate the data as to trends or other observations.
- Provide a formal transmittal to the laboratory data and Quality Assurance/Quality Control (QA/QC) to the EPA.
- Submit a proposed modification to the current Soil Gas Monitoring program, based on the findings of the current soil gas conditions.

4.3.1.2 Summary of Prior Soil Gas Investigations

1. The WDIG and EPA conducted soil gas investigative activities during 1997 and 1998, under WDIG's 1997 RD Investigative Activities Workplan (TRC, 1997a) and EPA's 1997 Subsurface Gas Contingency Plan (EPA, 1997c). These activities included geoprobe soil gas screening, two soil gas monitoring rounds, in-business air monitoring, the addition of 22 vapor wells installed by WDIG, and the completion of four soil gas monitoring rounds performed by WDIG. Figure 3.8 shows the complete vapor well monitoring network by area.
2. The following criteria were the primary objectives for performing the soil gas characterization activities:
 - Determine current soil gas conditions in the following areas:
 - Perimeter of the Site.
 - Adjacent to onsite structures.
 - Interior of the Site.
 - Determine trends in the historical data.
 - Evaluate if other compounds that have currently not been assigned site-specific action levels may pose a risk.
3. Interim Action Levels (IALs) for benzene and were established as part of EPA's Subsurface Gas Contingency Plan and the Amended Administration Order, Docket 97-09, based on the potential migration of subsurface gas into onsite businesses. A more detailed description of the rationale for these IALs is provided in EPA's Subsurface Gas Contingency Plan and the Amended Administrative Order (see Chapter 1.0).
4. To address the risks from methane, EPA used the California Integrated Waste Management Board's (IWMB's) methane action level in buildings as their criteria. The IWMB's criteria is as follows:
 - Methane levels in buildings will be below 1.25 percent (i.e., 25 percent of the methane lower explosion limit of 5 percent).

- Subsurface methane levels at the Site boundary must be below 5 percent based on California IWMB requirements. An ITSL of 1.25 percent was used by EPA in evaluating the results of the Subsurface Gas Contingency Plan Investigations Report.

4.3.1.3 Additional Soil Gas Activities

1. In July 1998, EPA installed an additional 10 nested vapor wells (VW-54 through VW-63). The nested wells were installed at the locations shown in Figure 3.8, as discussed in Section 3.3.

4.3.1.4 Soil Vapor Monitoring Results

1. Tables 4.13 through 4.16 summarize the analytical results for each sampling event conducted during 1998 for COC with ITSLs. Figures 4.24 through 4.28 present the methane, benzene or data by areas.

4.3.1.5 Conclusions

1. Conclusions for the Subsurface Gas Monitoring program are summarized below by site area.

4.3.1.5.1 Area 1

1. In Area 1, the vapor well results indicate the following conditions:
 - Perimeter wells: The perimeter wells in Area 1 are all below the California IWMB 5.0 percent methane standard. VW-35 (deep well), near Los Nietos Road, has shown elevated TCE levels above the ITSL.
 - Onsite structures: VW-18 located near the southeast corner of the Site between two buildings has shown elevated benzene levels above the ITSL. VW-44 (deep well), adjacent to Buffalo Bullet, showed elevated levels during the first three quarters of monitoring, but dropped below the ITSL in the October sampling event. In-business monitoring of buildings in this area has shown no evidence of soil gas infiltration.
 - Data trends: No significant trends were observed in Area 1. However, due to the existence of numerous abandoned industrial septic tanks in the area, the COC in this area may be because of dumping rather than reservoir crude oil activities.
 - Other compounds: VW-10 exceeded the ITSL for but decreased to below the ITSL during the October 1998 sampling event.

Tables 4.17 and 4.18 provide a summary of the ITSL exceedances in Area 1.

2. Based on the data collected during the six quarters, the soil gas levels in Area 1 appear to be relatively stable, or in some cases decreasing slightly.

4.3.1.5.2 Area 2

1. The vapor wells in Area 2 have shown the following conditions:
 - Perimeter wells: All of the perimeter wells on the north portion of Area 2 are below the California IWMB criteria and ITSLs.
 - Onsite structures: There are no onsite structures located in Area 2.
 - Data trends: VW-43 (intermediate and deep wells), -45 (shallow and intermediate well) and -48 (shallow, intermediate and deep wells) have shown elevated levels of methane, benzene and .
2. Two wells, VW-45 and -48, have shown elevated methane, benzene and levels in the shallow, intermediate and deep wells. These wells are adjacent to the reservoir and may be located in impacted areas (i.e., sump-like material). VW-43, both intermediate and deep wells, have shown elevated levels of methane and near the eastern edge of Area 2.
3. RI vapor wells, VW-02 and -03, have shown elevated methane levels above the ITSLs but below the California IWMB standards. VW-4 located in the reservoir area has shown elevated methane levels above 15 percent, and elevated and benzene levels above the ITSLs.
4. Soil gas levels in Area 2 are generally higher than the remainder of the Site because of the elevated methane and VOC levels in the reservoir. Soil gas levels appear to be relatively stable in Area 2.
5. Tables 4.17 and 4.18 provide a summary of the ITSL exceedances in Area 2.

4.3.1.5.3 Areas 3, 4 and 5

1. Vapor well monitoring in Areas 3, 4 and 5 has indicated the following conditions:
 - Perimeter wells: All perimeter wells in Areas 3, 4 and 5 are below the California IWMB standards.
 - Onsite structures: Well VW-51 (intermediate and deep wells), located near the Brothers facility, has shown elevated methane, benzene and levels as discussed below. In-business monitoring of the Brothers building has shown no evidence of soil gas infiltration.

2. VW-51, located near the Brothers facility, has shown elevated methane levels exceeding the 5 percent level in both the intermediate and the deep zones. VW-51-18 (intermediate well) has shown levels of 32.8 percent methane and benzene levels of 6,500 ppb during the October monitoring. VW-51-30 (deep well) during this same period has shown methane, benzene and levels of 32 percent, 36 ppb and 16 ppb, respectively. Based on these results, additional monitoring of VW-51 is required.
3. Area 5 was included in a recent SVE Treatability Study. The October 1998 monitoring was conducted after completion of the SVE Treatability Study. Soil gas levels in VW-51 have appeared to increase after the study. This phenomenon may require additional evaluation.
4. Tables 4.17 and 4.18 provide a summary of the ITSL exceedance in Areas 3, 4 and 5.

4.3.1.5.4 Areas 6 and 7

1. Vapor well monitoring of Areas 6 and 7 has shown the following conditions:
 - Perimeter wells: All perimeter wells in Areas 6 and 7 are below the California IWMB standards and ITSLs.
 - Onsite structures: There are no onsite structures in Areas 6 and 7.
 - Data trends: No significant trends were observed.
2. VW-25 (RI well) has shown varying methane levels since 1989. After completion of the SVE testing in Area 7, the methane concentrations in VW-25 have dropped from approximately 50.7 percent and 33.4 percent in February and April, respectively, to 6.5 percent and 15.5 percent in the July and October monitoring. The July monitoring may have been affected by SVE activities in Area 7. VW-25 has continued to be monitored, and methane levels continue to remain at a lower level (14.5 percent in February 1999 and 12.0 percent in April 1999).
3. Tables 4.17 and 4.18 provide a summary of the ITSL exceedance in Areas 7 and 8.

4.3.1.5.5 Area 8

1. Vapor well monitoring in Area 8 has indicated the following conditions:
 - Perimeter wells: All perimeter wells in Area 8 are below the California IWMB standards and ITSLs.
 - Onsite structures: VW-13 (RI well), VW-23 (RI well) and VW-55 have shown elevated methane and levels above the ITSL, but below IALs. In-business air monitoring of structures in these areas has shown no indication of soil gas infiltration.

- Data trends: No significant trends were observed.
 - Other compounds: Area 8 appears to have more detectable levels of chlorinated solvents, (i.e., PCE, TCE, etc.) especially in the southeastern portion. VW-22 (RI well) exceeded the ITSL for TCE in the four quarters of monitoring.
2. In Area 8, VW-23, which has shown levels of above the ITSL, has shown a steady decrease in concentration throughout the six quarters, with levels ranging from <20 ppb to 40 ppb for the February, April, July and October sampling events, respectively. VW-23 has also shown a corresponding decrease in methane levels from 4,200 to 330 ppm in the October sampling.
 3. Soil gas levels in Area 8 appear to be stable, and in several cases are decreasing. Tables 4.17 and 4.18 provide a summary of the ITSL exceedances in Area 8.

4.3.2 ANNUAL IN-BUSINESS AIR MONITORING RESULTS

1. An Annual In-Business Air Monitoring Report was submitted to EPA in March 1999 to provide a summary and evaluation of the methodology, and the in-business air data collected by WDIG from February 1998 through November 1998 at the Site.
2. The purpose of the annual report was to review the indoor air conditions of multiple onsite businesses for the site's primary COC (i.e., methane, benzene, TCE, PCE and toluene). The businesses that were monitored during 1998 were selected by the EPA and WDIG based on their relative location to the subsurface material at the Site (see Figure 4.29). The quarterly monitoring was performed with the following objectives:
 - Provide a summary of the in-business air data collected during 1998 by WDIG.
 - Evaluate the data as to trends or other observations.
 - Provide a formal transmittal of the laboratory data and QA/QC information to EPA.
 - Submit a proposed modification to the current In-Business Air Monitoring program, based on the findings of the in-business air conditions.
3. The data is based on eight sampling events (February 1998 through April 1999 time frame). The indoor air monitoring was initially performed on a monthly basis as requested by EPA because of concerns over potential in-business exposures. After the initial three monitoring rounds (a total of 3 months), the monitoring was decreased to quarterly, concurrent with the vapor well monitoring.

4. Eleven onsite locations were monitored during 1998. Table 4.19 shows the frequency on which sampling occurred for each location.
5. During WDIG's in-business air monitoring, additional information was collected on the chemical inventories for some of the businesses. Refer to Table 4.20 for a summary of the inventory data collected by EPA and the additional information collected by WDIG.

4.3.2.1 In-Business Air Monitoring Results

1. Table 4.21 provides a summary of the COC ITSL exceedances for the in-business air monitoring for Areas 1, 5, 7 and 8. The following subsections address these exceedances and provide a brief explanation for the possible cause.
2. Figure 4.29 summarizes the analytical results for each sampling event conducted during 1998 for the primary COC.
3. As indicated above, in-business air monitoring conducted for over 1 year has shown no indication of soil gas infiltration into the onsite businesses. Data presented by EPA indicated that soil gas was not infiltrating into onsite businesses. WDIG has since completed seven rounds of in-business monitoring and has confirmed that soil gas infiltration has not been observed.

4.3.3 TM NO. 9A - SOIL VAPOR EXTRACTION TREATABILITY STUDY

4.3.3.1 Introduction

1. The purpose of TM No. 9A activities was to develop additional field data on various soil gas parameters, including gas generation rates and gas conductivity, in designated areas which have shown elevated methane and VOC concentrations. TM No. 9A activities were performed in two phases. Phase I consisted of active SVE treatment at five designated areas of the Site. Phase II consisted of gas recovery monitoring which was initiated immediately following the Phase I activities.
2. The objectives of the SVE testing were to determine the following site-specific parameters at each of the five test locations:
 - Air conductivity in each layer adjacent to the gas-producing, sump-like material layer.
 - SVE radius of influence.

- Flow versus vacuum ratios.
 - Long-term soil gas concentrations, including rebound.
 - Condensate production.
 - Vapor extraction system and treatment effectiveness.
3. TM No. 9A Phase I activities were completed between June 1998 to September 1998. The final monitoring round of the Phase II activities was completed in January 1999.

4.3.3.2 SVE Testing Rationale

1. SVE testing was intended to provide information on the ability of SVE to remove subsurface soil gas (i.e., methane, VOCs) from the shallow fill zone and the underlying native soil, as well as to measure methane generation rates in these layers following SVE treatment. These parameters were determined by collecting both field measurements and analytical laboratory data on the SVE operating conditions and gas constituents during both Phase I and Phase II activities.
2. The SVE testing program was designed to generate data on the ability of an induced subsurface vacuum to withdraw soil gas from five onsite locations selected to represent the different combinations of soil conditions and the proximity between sump-like material and onsite buildings. Refer to Figure 4.30 for test area locations. The SVE data were used to evaluate the air conductivity and potential zone of influence in each area. This measured ability or inability to withdraw soil gas is critical to future consideration of vacuum induced soil gas controls as potentially viable remedial options including the potential for soil gas migration control by SVE.
3. Four of the five SVE test locations were selected based on the presence of sump-like material near potential surface receptors, such as onsite commercial/industrial buildings. The fifth area, Area 8, was included in the test because, although it is outside the footprint of the sump-like material, vapor wells in the area have previously shown elevated levels of VOCs during quarterly soil gas monitoring.

4.3.3.3 Summary of TM No. 9A Activities

1. The scope of work for TM No. 9A activities included the following list of tasks for each SVE test area:
 - Installation of two extraction wells (one shallow well in the fill soils and one deep well in the native soils), eight monitoring wells (four shallow and four deep) and four air injection wells (four deep).
 - Monitoring of baseline conditions of extraction wells.
 - Monitoring performance of the SVE unit, soil gas concentrations and radius of influence during Phase I.
 - Monitoring the soil gas recovery rates during Phase II.
2. The results of SVE testing were used to calculate the following specific soil gas parameters:
 - Air conductivity in the test layers (i.e., fill and native material)
 - methane generation
3. In four of the five test locations two soil vapor extraction wells (one shallow and one deep) were installed. The SVE extraction wells were then surrounded with a specific geometric pattern of zone of influence monitoring wells, and air injection wells. The zone of influence monitoring wells were increasingly distant in different directions from the extraction well to determine the maximum distance at which the extraction vacuum can be measured. In the RV storage lot (Area 2) test location, only one shallow extraction well and four shallow monitoring wells were completed, because of the presence of a perched water zone in the deeper native material. Air injection wells were installed in the native soil, beneath the sump-like material layer, except in Area 8, which was located outside the sump material. As indicated above, in the RV storage lot (Area 2), only the shallow test wells were completed, and therefore no air injection wells were installed. The injection wells were arranged in a square geometry around the extraction wells to allow the subsurface area to be swept by SVE.
4. The stratigraphy of the materials encountered was relatively consistent. A silty sand to sandy silt fill layer of at least 5 feet thick occurs over a layer of stained clays (drilling muds), comprising the sump-like material. RV storage lot (Area 2) did not have a deep zone of monitoring because of a perched water zone in the native zone. Area 8 was located outside the sump-like material, and therefore no sump-like material was encountered.

5. Prior to the start of SVE operations, the extraction well was purged of two to three well volumes, or until a steady soil gas concentration was observed. The purged gas was monitored for Oxygen (O₂), methane, Carbon Dioxide (CO₂) and total VOCs using field instruments (i.e., LANDTEK Methane Monitor).
6. A vacuum was then applied to the extraction well using a commercially available SVE unit rented from King Buck, Inc. of San Diego, California. The gas extracted from the well was treated using a catalytic oxidizer built into the SVE unit and discharged to the atmosphere.
7. Throughout TM No. 9A activities (Phases I and II), the following data were collected on a routine basis from the extraction well, and from the postblower and stack sample points on the SVE unit:
 - Blower vacuum
 - Blower flow rate
 - Barometric pressure
 - Concentrations of the following parameters were monitored by field equipment and sampled using summa canisters for laboratory analysis:
 - methane
 - TNMOC
 - O₂
 - CO₂
 - Benzene
 - VC
 - Other VOCs

The vacuum in the zone of influence monitoring wells and the extraction wells was also monitored on a regular basis.

8. After a pressure equilibrium was achieved at the maximum vacuum and flow fields, the SVE test was run under constant conditions for up to 2 weeks until soil gas levels became asymptotic or reached acceptable levels. At the end of the active SVE testing phase (Phase I), the system and extraction well were sampled, and then shut off to allow recovery of the system (Phase II).
9. During the recovery monitoring phase (Phase II), EPA requested that monitoring of the zone of influence wells be conducted. During this additional monitoring phase, it was determined that the O₂ levels were unexpectedly high in some of the extraction and monitoring wells. It was therefore determined that the SVE extraction and monitoring wells be purged of at least one to three well volumes prior to sampling. The well purging process was continued

throughout the remainder of the Phase II activities. During this sampling, all of the extraction, monitoring and air injection wells were purged and sampled. Only field data were collected from these wells.

4.3.3.4 Summary of TM No. 9A Results

4.3.3.4.1 Zone of Influence Calculation Results

1. Various methods have been used to evaluate the potential zone of influence by SVE. The most practical method to estimate the zone of influence is to graph the observed vacuum in monitoring probes versus the distance from the SVE extraction well.
2. Using the observed vacuum levels collected during TM No. 9A activities from the various monitoring points, the data were plotted for each area. Table 4.22 provides a summary of the estimated zones of influence by area.
3. Based on the estimated zone of influences presented in Table 4.22, the following was observed in relation to the SVE zone of influence:
 - Shallow areas demonstrated limited zones of influence because of the following conditions:
 - Shallow soils were affected by vertical air infiltration.
 - Shallow soils are more prone to preferential pathways, which can reduce the effective zone of influence.
 - Deep zones demonstrated larger calculated zones of influence ranging from 122 feet to 200 feet. The observed larger zones of influence in the deep soils are likely because of the following reasons:
 - Local lithology of deep zones indicate a higher potential permeability.
 - Deep SVE zones were covered by a low permeable waste layer which increases the effective vacuum by preventing vertical leakage during SVE.
 - Native soils in the deep SVE test are less likely to exhibit preferential flow because of utilities (e.g., pipeline) or other disturbances, as compared to the shallow soils.
4. Based on the SVE data presented in Chapter 3.0 of the ROF (TRC, 1999c), and the zone of influence calculations presented above, the TM No. 9A results indicate that SVE using conventional extraction techniques (i.e., <100 in. WC) and equipment was able to:
 - Generate a zone of influence greater than 30 feet in the shallow fill soils.
 - Generate a substantially greater zone of influence, ranging from 122 to up to 200 feet in the deep native soils. In actual field conditions an effective zone of influence of 80 to 100 feet would be expected.

4.3.3.4.2 Air Conductivity Modeling Results

1. To further evaluate the SVE data, the U.S. Army Corp. of Engineers recommend using an SVE data reduction model called GASSOLVE, which was developed by Clemson University. The focus of this model is to calculate the intrinsic permeability of the soil, using various SVE data inputs, and assumptions and default parameters. The GASSOLVE model calculates the intrinsic permeability, both horizontally and vertically, along with a statistical evaluation of error range of the permeability estimate.
2. The GASSOLVE results for the shallow SVE tests indicate the following (see Table 4.23):
 - **Horizontal Permeability** - Permeabilities ranged from $1.8 \times 10^{-8} \text{ m}^2$ in Brothers (Area 5), to $6.2 \times 10^{-12} \text{ m}^2$ in Area 7. This indicates a generally low permeable soil type consistent with silty sands.
 - **Vertical Permeability** - Vertical permeabilities for the shallow soils were generally on the same order of magnitude as the horizontal permeability, indicating significant surface leakage.
 - **Average Error** - Average errors were generally low, with the exception of Brothers (Area 5). The average error in Area 5 was 33.6 percent. This appears to be caused by variations flow rates and in vacuum levels during testing. The variation in results may be related to short circuiting along preferential pathways, since the area has been subject to various disturbances.
3. The GASSOLVE results for the Deep SVE tests indicate the following (see Table 4.23):
 - **Horizontal Permeability** - Permeabilities ranged from $5.4 \times 10^{-11} \text{ m}^2$ at C&E Die to $8.9 \times 10^{-11} \text{ m}^2$ in Brothers (Area 5). This indicates a slightly more permeable soil type relative to the shallow soils.
 - **Vertical Permeability** - Vertical permeabilities were generally 2 to 4 orders of magnitude lower than the horizontal permeabilities, indicating only marginal air leakage from the surface.
 - **Average Error** - Average errors were generally very low (e.g., less than 5 percent).
4. Table 4.24 provides a comparison of the calculated intrinsic permeabilities and the local lithology as discussed above. As shown in Table 4.24, the results of the GASSOLVE modeling are comparable to the local soil conditions.

4.3.3.4.3 Soil Gas Recovery and Generation Evaluation

1. During the soil gas recovery monitoring, the SVE treated areas appeared to go through three phases. These phases were:
 - **Prior to Purging** - After discontinuation of the active SVE, the gas levels (e.g., methane, CO₂ and O₂) remained relatively stable.
 - **Aerobic Phase** - During this phase, the wells showed increasing levels of CO₂ and slightly decreasing O₂ levels. This trend appears consistent with aerobic degradation of petroleum hydrocarbons in the soil.
 - **Anaerobic Phase** - After CO₂ levels increased and oxygen levels decreased, low levels of methane were observed to gradually increase. This is consistent with anaerobic degradation of petroleum hydrocarbons.
2. Table 4.25 provides a summary of the soil gas levels at the time of SVE shutdown, and the final soil gas recovery monitoring conducted in January 1999.
3. The following trends were observed during the SVE and monitoring periods:
 - **Shallow Soils:**
 - Shallow soils demonstrated very low methane levels and slightly elevated CO₂, as shown in Figure 4.31.
 - O₂ level decreased during the rebound monitoring as anticipated.
 - Benzene levels were generally below ITSLs and declined throughout the test as shown in Figure 4.32.
 - Vinyl chloride levels exceeded the ITSL during the initial rebound phase but declined during further monitoring as shown in Figure 4.33.
 - **Deep Soils:**
 - methane levels increased only slightly during rebound monitoring as compared to the shutdown levels, as shown in Figure 4.31.
 - Benzene levels were generally below ITSLs and declined throughout the test as shown in Figure 4.32.
 - Vinyl chloride levels exceeded the ITSL during the initial rebound phase but declined during further monitoring as shown in Figure 4.33.
 - O₂ level decreased in all areas except Area 8, which is consistent with biodegradation. Area 8 O₂ level increased slightly.
 - CO₂ levels increased in all areas except Area 8, which is also consistent with biodegradation. The CO₂ levels in Area 8 decreased slightly.
4. SVE test data were used to calculate methane generation, based on the concentration in the extraction flow rate. The methane generation rate was calculated separately for SVE tests in the shallow fill layer and in the deep native soil layer. These generation rates were compared with the fundamental calculation discussed next.

5. The potential rate at which gas is generated in the sump-like material layer was first evaluated on a theoretical basis, using the anaerobic reactions that decompose petroleum hydrocarbons and other organic compounds. The sump-like materials below the cover fill layer were represented by a generic alkane, whose size, $\text{CH}_{24}\text{H}_{51}$, is midway in the range of hydrocarbons found at the Site. This layer of sump-like materials is assumed to be the only source of significant gas generation.
6. Overall, the low gas generation rate in the sump-like material appears incapable of causing enough upward or outward migration of methane and other constituents to be a health risk to people working in onsite businesses or offsite residences, schools, etc. The flux is also so low that it may potentially be safely vented to the atmosphere rather than requiring a gas destruction system. As an example, in the area of C&E Die, some localized hot spots were observed during SVE rebound monitoring. These hot spots appear isolated, and may be related to localized waste materials or other debris disposed in the area, which is consistent with the small mass of contaminants observed in the extracted gas.

4.3.3.4.4 Summary of SVE Performance

1. The objective of the treatability testing was to evaluate the performance of SVE under field conditions. As part of the treatability study, the following performance characteristics were evaluated:
 - Well extraction performance characteristics (i.e., step tests):
 - Step testing was attempted, but was not considered crucial, since the existing vapor well design has clearly established the well design characteristics and capabilities.
 - In-situ air permeability:
 - This was determined using the GASSOLVE modeling.
 - Well gas and effluent gas contaminant concentrations.
 - Potential effects of SVE on local conditions such as ground water.
2. To evaluate the SVE performance, constant rate performance testing was used. Constant rate performance tests are conducted under steady-state conditions to ensure that a representative area of influence is obtained. Relatively stable flow conditions were produced. One exception was the shallow Area 7 wells, which exhibited very low corrected flows because of the low permeability of the soils.

3. Based on the results of the zone of influence modeling, the GASSOLVE modeling and the gas recovery data, the objective of the SVE performance evaluation has been achieved.

This includes:

- Well extraction characteristics:
 - Sufficient data were obtained on wellhead flow and vacuum to allow, if necessary, for design of an SVE system.
 - Sufficient data were obtained on the well characteristics to evaluate the feasibility of SVE, for remedial selection purposes.
- In-situ air permeability:
 - Sufficient air permeability data were collected in five distinct site areas and at two depths as indicated by the GASSOLVE modeling results.
- Well gas at effluent gas constituent concentrations:
 - Sufficient data were generated on the soil gas characteristics to allow, if necessary, the design of an SVE system as part of a remedial action.
- Potential effects of SVE on local conditions:
 - No effects were observed on ground water levels in the test area.

4.3.3.4.5 SVE Gas Recovery Estimates

1. As part of the TM No. 9A evaluations, an estimate of the mass of contaminants removed during SVE activities was calculated using the method indicated in *Soil Vapor Extraction and Bioventing*, U.S. Army Corps of Engineers (EPA 1110-1-4001, November 1995).
2. As indicated in Tables 4.25 and 4.26, the mass removal estimates indicated the following:
 - Shallow Soils:
 - methane removal ranged from 0.14 pounds (lbs) in Area 5 to 4.2 lbs in Area 7.
 - Benzene removal ranged from 0 lbs in Areas 5 and 8 to 7.0×10^{-5} lbs at C&E Die.
 - Vinyl chloride removal ranged from 0 lbs in Areas 7, 8 and 5 to 2.0×10^{-5} lbs at C&E Die.
 - Deep Soils:
 - methane removal in the deep soils was significantly greater than in the shallow soils. Removal levels ranged from 0.17 lbs in Area 8 to 977 lbs in Area 5. As shown in Table 4.27, both Area 5 and C&E Die yielded substantially larger masses of methane than the other areas. This is consistent with the levels of methane observed during active SVE.
 - Benzene removal in the deep soils was consistent with the shallow soil results. Removal masses ranged from 0 to 0.019 lbs in Area 5.

- Vinyl chloride removal from the deep soils was also consistent with the shallow soils removal levels. Removal levels ranged from 0 to 0.0128 lbs in Area 5.

4.3.3.4.6 SVE Gas Treatment Evaluation

1. As part of the overall evaluation of SVE as a potential Remedial Technology for gas control at the Site, an evaluation of the offgas treatment technology was included as one of the overall objectives. Treatment technologies for methane and VOC containing gas streams include the following:
 - Direct emission or release.
 - Adsorption into carbon.
 - Incineration:
 - Incineration using controlled temperature, air flow.
 - Incineration using direct combustion, such as flares.
 - Catalytic oxidation.
2. Treatment or destruction efficiency observed during the above SVE activities ranged from 0 to approximately 60 percent. These levels are relatively lower than anticipated. Although the destruction efficiency was low, there was no significant release of soil gas constituents to the atmosphere. The reasons for the lower-than-expected treatment levels may include the following:
 - **Low Oxygen Concentrations** - O_2 is required to be present in the gas stream for a catalytic oxidizer to perform optimally. In most of the test areas, O_2 levels were generally low (i.e., C&E Die, deep testing), which may have prevented or reduce the efficiency of the catalytic oxidizer. Intake air, added to the air stream is designed to increase O_2 levels and improve treatment.
 - **Low Contaminant Concentrations** - The actual mass of contaminants extracted was relatively low in comparison to typical SVE sites, such as USTs and gasoline station cleanup. As the concentration of the gas stream decreases, generally the destruction efficiency also decreases.
 - **Catalytic Oxidizer Temperature** - The catalytic oxidizer temperature may have been too low to initiate to oxidation reaction, given low O_2 levels and low constituent levels.

4.3.3.5 Summary of Findings

1. Based on the data collected during TM No. 9A activities, the following findings are reported:
 - Site gas generation (i.e., rebound) was very low which is consistent with the gas generation levels theoretically determined in the February 1998 gas generation calculations submitted to EPA.
 - TM No. 9A rebound data confirms that the Site has a low overall gas generation potential.
 - SVE was shown to be effective in reducing soil gas levels in the selected areas.
 - Soil gas extraction removed a relatively small mass of contaminants, (i.e., lbs) as compared to typical landfill or gas station remediation which can generate tons of material.
 - Very low levels of soil gases were extracted from the shallow fill soils adjacent to buildings, indicating that the fill soils are not a significant potential source of emissions to onsite businesses.
 - In the deep soils, SVE reduced the soil gas levels significantly, and created a large zone of influence which appears to have temporarily enhanced aerobic biodegradation of the petroleum hydrocarbons.
2. SVE has been shown to be technically feasible for the control of soil gases in the areas outside the reservoir area. Furthermore, SVE data also indicate that a passive technology, such as passive bioventing, may be feasible for gas control at the Site. The data collected during TM No. 9A will be used during the FS to further reevaluate the control of soil gas in selected areas at the Site.

4.4 ANNUAL GROUND WATER MONITORING

1. An annual report was submitted to EPA in March 1999 to review the ground water conditions at the Site and to evaluate potential ground water contamination from WDI sources (TRC, 1999d). The report was prepared with the following objectives:
 - Summarize the ground water data collected by the WDIG from September 1997 through October 1998.
 - Evaluate the data as to trends or other observations.
 - Provide a formal transmittal of the laboratory data and QA/QC to the EPA.
 - Submit a proposed modification to the current ground water monitoring program, based on the findings of historical and current ground water conditions.
2. On January 14, 1999, CDM Federal submitted to the EPA a ground water evaluation report for the Site (CDM Federal, 1999d). The purpose of the evaluation was to review and assess

the ground water monitoring and source characterization data, to update the conceptual model for the Site, and to establish a framework for future long-term ground water monitoring programs. These findings have been incorporated herein.

4.4.1 REGIONAL AND SITE HYDROGEOLOGIC CONDITIONS

1. CDM Federal's Ground Water Data Evaluation Report provides a detailed description of the regional and site hydrogeologic conditions. The source for CDM Federal's hydrogeologic summary was collected from previous site investigations/characterizations conducted during the 1988 and 1989 RI (EBASCO, 1989b) and subsequent site monitoring data. The following sections summarize the information provided in CDM Federal's report.

4.4.1.1 Regional Hydrogeologic Conditions

1. The Site is located in the Whittier Area in the Montebello forebay of the Los Angeles Central Ground Water Basin. Regional geological maps indicate that Recent age alluvium sediments, consisting of sand and gravel, with occasional lenses of clay underlie the Site. The recent sediments in the near vicinity of the Site attain a maximum thickness of approximately 80 feet and are underlain by the Lakewood and San Pedro formations (primarily Pleistocene age fluvial sedimentary deposits).
2. The Lakewood formation includes the Artesia and Gage aquifers. These aquifers consist of mostly sand interbedded with clay lenses. The Hollydale, Jefferson, Lynwood, Silverado and Sunnyside aquifers are found in the San Pedro formation. This formation consists mostly of sands and gravels, which are also separated by clay lenses.

4.4.1.2 Site Hydrogeologic Conditions

1. Based on RI soil boring characterization (EBASCO, 1989a), the subsurface stratigraphy and materials encountered at the Site include:
 - Five to 15 feet of fill material covering the concrete reservoir, waste containment areas, and most of the remainder site.
 - An interval of clay and sandy silt, 10 to 25 feet thick underlies the fill and sump-like material.

- The near-surface silt layer is underlain by sandy, pebbly, channelized braid river (fluvial) deposits, at least 50 feet thick. These fluvial deposits include medium- and coarse-grained sand and fine-gravel interbedded with discontinuous layers and lenses of clay and silt. A 10-foot thick unit of silt and clay is interbedded with the coarser-grained river deposits in the southeast portion of the Site.
 - During the 1988-1989 soil boring investigation, ground water was encountered in the upper interval of the sandy and pebbly river deposits at depths ranging from 48 to 65 feet bgs.
 - RI borings, drilled to depths of 80 to 130 feet bgs, indicate that interbedded sand and pebbly sand units underlie the shallower fluvial channelized deposits.
2. Recent monitoring (October 1998) shows the depth to ground water at the Site to range from approximately 28.5 feet bgs (GW-02) to 48.5 feet bgs (GW-23/GW-24). Table 4.27 shows recent ground water depths measured at the Site during October 1998. Table 4.28 shows historical ground water elevations at the site since October 1988.
 3. Ground water flow at the Site is to the south and southwest. Refer to Figure 4.34 showing the ground water contour map during the 1998 monitoring period for the Site.

4.4.1.3 Site Ground Water Conditions

1. CDM Federal calculated the hydraulic gradients (horizontal and vertical), flow velocity and prepared hydrographs for the ground water conditions using monitoring data collected prior to September 1997. The following summarizes the information provided by CDM Federal:
 - Horizontal Ground Water Gradient:
 - Ranges from 0.002 feet/foot (western portion) to 0.003 feet/foot (eastern portion).
 - Increase to 0.035 feet/foot at the southwest corner of the Site.
 - Vertical Ground Water Gradient:
 - Maximum downward gradient was 0.052 feet/foot (GW-15 and -16).
 - Vertical hydraulic gradients for well pairs were similar for the 1991 and 1997 monitoring events.
 - However, a significant elevation difference (6.03 feet) and downward gradient (0.121 feet/foot) was observed at well pair GW-23/GW-24.
 - Ground Water Flow Velocity:
 - Based on assumed hydraulic conductivities (50 gallons per day per square foot [gpd/ft²] for silty/clayey sand; 500 gpd/ft² for pebbly sand), velocity of the ground water flow at the Site is estimated to range from 6 to 60 feet/year (EPA, 1993a).

- Ground Water Hydrographs:
 - Water level trends evident for each well are very similar with a moderate increase in water level between 1988 and 1992, and a pronounced increase between August 1992 and June 1995 monitoring events. September 1997 water levels have declined less than one foot from levels observed during September 1995.
 - During the monitoring period reviewed, the highest ground water elevation measured in the vicinity of the buried reservoir was 119.9 feet above mean sea level (msl) (GW-04, September 1995), which is approximately 20 feet below the estimated base of the concrete reservoir.
 - The pronounced rise in water levels documented in the Site wells for 1992 through 1995 were explained as a period of active aquifer recharging in the Montebello Forebay spreading grounds, which are located immediately north and upgradient of the Site. Water levels in the Montebello Forebay wells rose 10 feet or more during this period as a result of the water replenishment operations (TRC, 1996b).
 - Ground water elevations appear to have stabilized with minimal fluctuations in depths since 1995. Refer to Table 4.28 showing the change in elevation from previous monitoring episodes.
- 2. Since the physical characteristics (i.e., depth to ground water, flow direction) of the ground water conditions have not changed significantly at the Site during WDIG's 1998 monitoring program, WDIG concurs with CDM Federal's ground water findings.

4.4.2 GROUND WATER SAMPLING RESULTS

1. This section summarizes the chemical characteristics of ground water conditions at the Site. This summary was generated from the data compiled since ground water monitoring was initiated in 1988.
2. In September 1997, site ground water monitoring was reinstated when split sampling occurred with EPA and WDIG. Since then, WDIG has been performing quarterly sampling of the complete well network at the Site. Table 4.29 provides the EPA methods used for laboratory analysis of the ground water samples collected by WDIG. Figures 4.35 through 4.38 provide a summary of the ground water monitoring data.
3. The following summarizes the analytical ground water conditions at the Site conducted by EPA and WDIG sampling events since 1988:
 - VOCs:
 - The most common VOCs reported for ground water samples are TCE and PCE.

- TCE and PCE are the only VOCs that have been detected above their MCL (5 µg/L for both parameters) in ground water samples.
- Toluene was detected during several of EPA's monitoring events.
- SVOCs:
 - Ground water analysis for SVOCs since 1988 has indicated no consistent pattern and are typically not detected in the ground water at the Site. SVOC detection may be the result of trace levels generated from laboratory contamination.
- Pesticides/PCBs:
 - Pesticides or PCBs have not been detected in the ground water.
- Metals:
 - Arsenic, chromium and lead analyses for ground water samples show no consistent distribution or detection above the MCL for these metals. Elevated concentrations of arsenic and chromium have been reported for the upgradient monitoring well (i.e., GW-01), but not consistently for wells across the Site. This indicates that the presence of arsenic and chromium may be an artifact or anomaly related to the GW-01 well location.
 - Ground water metals analyses have shown elevated concentrations of aluminum, iron, manganese, and selenium, locally at concentrations above primary or secondary drinking water standards (CDM Federal, 1999d). However, the consistency and distribution of detections (i.e., higher concentrations in upgradient wells) suggest that elevated concentrations of these metals represent a regional ground water quality condition, which probably is not related to migration from WDI waste sources.
- LNAPL and DNAPL:
 - At the Site, the measured concentrations of VOCs dissolved in ground water have never exceeded 100 µg/L for any potential LNAPL/DNAPL constituents. Therefore, because the ground water beneath the Site does not contain dissolved solvents or BTEX at concentrations exceeding 100 µg/L, and an oily sheen has not been observed in any ground water sample, it can be concluded, at present, that no LNAPL or DNAPL sources are contributing to ground water contamination at the Site.

4.4.3 SUMMARY

1. Several site COC (VOCs and metals) have been detected above their respective MCLs in the ground water samples. However, these exceedances do not appear to be related to site wastes based on their distribution in ground water (i.e., some contaminants are detected upgradient or cross-gradient from WDI waste sources).
2. VOCs detected in ground water samples are primarily PCE and TCE, with concentrations generally less than 20 µg/L. PCE and TCE concentrations in several locations are above their

respective MCL of 5 µg/L for primary drinking water. These VOCs have been detected only in the western part of the Site in both upgradient and deep monitoring wells. Based on ground water flow conditions, the distributions of detection, and information on offsite ground water contamination sites, the sources of PCE and TCE detected in the western portion of the Site appears to be from solvent releases associated with upgradient industrial sites.

3. Toluene has been detected sporadically by EPA (maximum concentration was 64 µg/L which is below its MCL[150 µg/L]) in ground water sampled adjacent to and downgradient of WDI waste sources. WDIG has not detected toluene in the ground water since April 1998.
4. CDM Federal concludes in their Ground Water Data Evaluation Report that no significant impact on ground water has been identified from the Site based on available ground water sampling results and the location and characteristics of the waste sources at the Site. WDIG concurs with this conclusion since data collected by WDIG from September 1997 through October 1998 are consistent with CDM Federal's.

4.5 STORMWATER

4.5.1 STORMWATER MONITORING

1. The Site's Stormwater Pollution Prevention Plan (SWPPP) has two objectives: (1) identify existing and potential sources of pollution which may affect the quality of stormwater discharges associated with the Site, and (2) propose and implement the necessary practices that will reduce the introduction of the potential pollutants into stormwater discharges associated with specific areas of the Site.
2. In 1998, WDIG and EPA designated five stormwater monitoring points onsite to meet the objectives of the SWPPP. Refer to Figure 4.39 for the locations of the monitoring points. Two of the monitoring points were designed to prevent potential flooding of buildings at two locations. Surface water runoff at the Site is conveyed through start flow and concentrated surface flow areas.

3. Analytical samples collected during the 1997-1998 rainy season indicated the following:
 - Low levels of total suspended solids.
 - Low levels of metals typical of surface soils.
 - No significant levels of site COC were detected.

Results of the stormwater samples are provided in Appendix G.

4.5.2 TM NO. 11 ACTIVITIES

1. Prior to the 1998-1999 rainy season, WDIG improved site conditions as described in TM No. 11 - Reservoir Area Grading and Waste/Debris Management (TRC, 1998a). The scope of work primarily consisted of improving the stormwater drainage from the reservoir to adjacent areas and structures. The scope also included the disposal of various investigative derived wastes and other miscellaneous debris from the reservoir area of the Site.
2. The following activities were conducted in accordance to the TM No. 11 scope of work:
 - Disposal of liquids, clean-out and removal of Baker Tanks.
 - Transportation of miscellaneous debris and concrete material from onsite stockpiles to offsite facilities.
 - Disposal of soil cuttings generated from previous EPA and WDIG soil investigations and monitoring well installations contained in 55-gallon drums, roll-off bins and soil sample cores.
 - Relocation of abandoned city bus from central portion of the reservoir area to the RV Storage Lot.
 - Elevation modifications to existing monitoring wells and probes within the reservoir area.
 - Regrading of the reservoir area.
 - Construction of drainage ditches and berms in selected areas.
 - Decontamination and removal of empty 55-gallon drums to an offsite facility.
 - Reseeding graded areas, including drainage ditches and berms.
3. The rationale for performing the activities outlined in TM No. 11 were as follows:
 - Reduce potential for flooding of nearby businesses (i.e., C&E Die, Buffalo Bullet and H&H Contractors).
 - Reduce potential for surface water infiltration into the concrete lined reservoir area.
 - Final management of investigative derived wastes and miscellaneous debris generated during EPA and WDIG field activities.

4. The scope of work performed during TM No. 11 field activities met the requirements outlined in specifications provided in the TM. Refer to TM No. 11 - Reservoir Area Grading Plans and Waste/Debris Management, dated September 1998 (TRC, 1998a).

5.0 COMPREHENSIVE SUMMARY OF SITE CONDITIONS

1. Based on the investigations presented in Chapters 2.0, 3.0 and 4.0, an overall understanding of the Site conditions has been developed and is shown in Figure 5.1. Media-specific summaries are shown in Tables 5.1 through 5.4. The figure and tables show that the Site can be divided into various zones so that different remedial alternatives can be evaluated in the Supplemental Feasibility Study (SFS) for each area based on the specific local site conditions. The following sections summarize the Site media conditions.

5.1 SUMMARY OF SOIL AND PERCHED LIQUIDS CONDITIONS

1. Figure 5.2 provides a delineation of the boundary of the extent of the sump-like materials, as determined using EPA and WDIG data collected during field activities conducted between 1988 through 1998. The extent of the sump-like material has been extended from the 1989 ROD and the 1995 Predesign limits.
2. Table 5.1 provides a brief summary of the findings of the soil investigations completed at the site between 1971 and 1998. The results of the chemical characterization of the fill soils, the sump-like material and the native soils indicate that the sump-like materials outside the reservoir are composed primarily of drilling muds mixed with minor amounts of debris and waste. The results of the 1997 WDI geoprobe chemical analyses indicate that these materials contain CERCLA hazardous constituents. However, the results of limited soils testing performed during TM No. 10 activities indicate that these materials are generally nonhazardous by TCLP and STLC criteria. As previously discussed, some elevated levels of arsenic, beryllium, lead, zinc and some VOCs and SVOCs were observed in the fill material during the 1988-1989 RI activities (see Tables 2.8 to 2.10), but have been found to be below hazardous levels by TCLP and STLC testing.
3. A cross section showing the Site lithology is shown in Figure 5.3. This figure provides an illustration of the subsurface soils of the Site.
4. The reservoir materials consist of approximately 5 to 15 feet of overlying fill soils intermixed with broken concrete and construction debris, and approximately 10 to 17 feet of waste material as discussed in Chapters 3.0 and 4.0. The waste material is composed of drilling muds, soils,

liquids and light crude oils. Chemical characterization of the reservoir materials has indicated the presence of elevated levels of the following types of constituents as indicated in Table 5.1:

- VOCs
 - Methane
 - BTEX
 - VC
 - Chlorinated Solvents
 - Aliphatic Hydrocarbons
- Metals⁽¹⁾
 - As
 - Be
 - Pb
 - Zn

5. The materials outside the reservoir consist of overlying fill material varying from approximately 0 to 10 feet in thickness. The fill is intermixed with broken concrete and construction debris. Drilling muds were also encountered outside the reservoir boundary typically ranging in thickness of a thin layer (e.g., less than 3 feet) to 12 feet. The drilling muds are intermixed with broken concrete, construction debris, liquids and light crude oil.
6. Reservoir liquids investigations performed by EPA and WDIG are summarized in Table 5.4. The results of the investigation indicate that the reservoir liquids contain CERCLA hazardous constituents, but at levels below the hazardous criteria. One exception is the presence of elevated PCB concentration in some areas, as discussed in Section 4.2.2.1.3. Additional data on the reservoir liquids will be obtained during the TM No. 13 Treatability Study, as discussed in paragraph 8 below.
7. Analyses of two perched liquid samples collected during the geoprobe investigation outside the reservoir resulted in no detectable levels of VOCs. These perched liquids are most likely infiltrated rainwater. Figure 5.4 shows the location of the liquids both inside and outside the reservoir boundary. The liquids encountered outside the reservoir were observed during the 1988-1989 RI and activities conducted during 1997 and 1998 field investigations by EPA and WDIG.

(1) ROD Standards for Be are below background levels, but are above Industrial PRGs. Arsenic levels at the Site are above PRGs, but are consistent with local background conditions. The ROD standards for arsenic are below background levels.

8. Currently, WDIG is conducting a treatability study for the removal of liquids within the reservoir boundary (TM No. 13 - Pilot Scale Treatability Study for Reservoir Liquids Removal). The purpose of the study is to quantify the effectiveness of liquids removed and to collect additional liquids data. After 10 weeks of operation, the liquids extraction system has recovered approximately 46,500 gallons of water and 175 gallons of oil from the reservoir. Data indicates that as pumping continues, liquid levels and pumping rates are markedly decreasing.

5.2 SUMMARY OF SOIL GAS CONDITIONS

1. As indicated in Table 5.2, based on the results of the RI, and the 1997-1998 EPA and WDIG investigations, elevated levels of Methane and VOCs are not prevalent over most of the Site, except within or near to the boundary of the sump-like material. Figure 5.5 shows an aerial photo of the vapor well network locations. The satisfaction of state regulatory criteria for boundary areas and areas near to most structures has been confirmed with the exception of the areas shown in Figure 5.5.
2. The data presented above indicate only a few isolated areas exceeding the CIWMB regulations for methane or the VOC ITSLs. Only consistent exceedances of ITSLs in two or more monitoring periods were considered in identifying these areas. Using the ITSLs for site boundary (see Figures 5.6 through 5.9), the following areas with verified exceedances have been identified:
 - Reservoir
 - Northwest Corner of Area 2 (RV storage lot)
 - C&E Die (Area 2)
 - Brothers Machine Shop (Area 5)
 - Northeast Portion of Area 8
 - Area 8 near the Auto storage yard
 - Southwest portion of Area 8
 - Area 7 Pit

The ITSLs and the COCs used for this evaluation are preliminary only, and may be revised when the final action levels and COCs are determined by EPA.

3. In-business air monitoring conducted by EPA in August 1997, and by WDIG since February 1998, has not demonstrated soil gas infiltration into the onsite businesses, as summarized in Table 5.2. EPA's Subsurface Gas Contingency Report concluded that no soil gas infiltration was observed during their monitoring activities, and that the VOCs detected

during monitoring were consistent with the onsite business chemical inventories developed by EPA. WDIG has since completed seven rounds of in-business air monitoring, which has confirmed EPA's initial conclusion that soil gas infiltration has not been observed.

4. SVE treatability testing conducted in various site locations, as described in Section 4.3.3, showed overall low levels of methane and VOCs. However, some elevated levels were observed in isolated wells before and after treatment of the area using SVE, as shown in Figures 4.32 through 4.34. SVE testing further showed that the volatile constituents could be removed by vapor extraction, and that the actual mass of soil gas constituents was relatively small. Based on the results of the SVE testing, methane generation rates were calculated, and were found to be very low.
5. Reservoir vapor well testing, using EPA's high vacuum extraction testing indicated that the reservoir may contain high levels of methane and VOCs, as indicated in Table 5.2. However, the high vacuum tests clearly indicate that the actual mass of methane and VOCs is very limited, as evidenced by the dramatic drop in BTU levels during the first 24 hours (e.g., <2,500 ppm methane). Based on this data, the reservoir does not appear to be generating large volumes of methane which is consistent with the gas generation calculations prepared in February 1998 and as discussed in Section 4.3.
6. Based on these results, soil gas at the boundaries of the waste zone appear to be isolated to a number of discrete areas of concern. The concentration and mass of the soil gases in these locations does not present a significant health risk, except in areas adjacent to onsite buildings.

5.3 SUMMARY OF GROUND WATER CONDITIONS

1. The results of the ground water monitoring conducted at the Site sporadically since 1989 have not shown site-related impacts (see Table 5.3). Ground water monitoring at the site will be continued.

6.0 SCHEDULE FOR FEASIBILITY STUDY, AMENDED ROD AND REMEDIAL DESIGN

6.1 REMAINING FIELD WORK

1. The scope proposed in the 1997 RD Investigative Activities Workplan (TRC, 1997a) has been completed. The only outstanding investigative field activity is the TM No. 13 - Pilot-Scale Treatability Study for Reservoir Liquids Removal. Other ongoing activities include:
 - Quarterly in-business air monitoring.
 - Quarterly vapor well monitoring.
 - Quarterly ground water monitoring.
 - Continued stormwater management.
 - Site fencing and signage maintenance.
 - Maintenance of site conditions (i.e., grass cutting).
2. In addition, the WDIG is committed to and is performing the scope of activities specified in TM No. 13 - Pilot-Scale Treatability Study for Reservoir Liquids Removal. The ongoing activities include:
 - Pumping TM-13 reservoir wells.
 - Treatment and disposal of the effluent from the wells.

6.2 DESIGN ACTIVITIES

1. The design activities, encompass data compilation and analysis, remedial alternatives review and selection, and remedial component design, are encompassed in the following main task descriptions as described in the Amended SOW:
 - Supplemental Feasibility Study
 - 90% and 100% Design Reports

6.3 ADMINISTRATIVE ACTIVITIES

1. Administrative activities include routine reporting, administrative record modifications/additions and public interaction. The main administrative tasks are the following:
 - Monthly Reports
 - Proposed Plan
 - ROD Amendment
 - Public Meetings
 - WDIG and EPA Remedial Action Agreement

6.4 MASTER SCHEDULE

1. The integrated Master RD/RA Schedule is shown in Figure 6.1. As is illustrated the general timeframes for the RD activities are:
 - Field Activities: TM No. 13 Activities April 1999 through May 2000
 - Monitoring Activities: Quarterly until at least the RA phase
 - Supplemental Feasibility Study
 - Design Activities
 - Administrative Activities: August 1998 through September 2000
 - RA Activities: After June 2001
2. It is anticipated that the most critical path elements of this schedule are:
 - Supplemental Feasibility Study Acceptance
 - ROD Amendment
 - 100 percent Design Acceptance
 - Remedial Action Agreement

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DRAFT

Table I. Summary Table of Reported Data for On-Site Vapor Wells at WDI Site

WELL	BENZENE (ppb)		VINYL CHLORIDE (ppb)		METHANE (ppm)	
Dates	3/89	6/95	3/89	6/95	3/89	6/95
VW-01	390	NO SAMPLE	ND ^a	NO SAMPLE	ND	3000^b
VW-02	189	2.5	ND	ND	16,200	9870
VW-03	ND	NO SAMPLE	ND	NO SAMPLE	ND	22,000
VW-04	150	1400	73	250	64,800	93,400
VW-05	58	NO SAMPLE	ND	NO SAMPLE	ND	6000
VW-06	ND	NO SAMPLE	ND	NO SAMPLE	ND	ND
VW-07	ND	ND	ND	ND	200	7730
VW-08	160	NO SAMPLE	ND	NO SAMPLE	ND	6000
VW-09	1700 16,000	NO SAMPLE	3300 12,000	NO SAMPLE	390,180 147,400	NO SAMPLE
VW-10	ND	NO SAMPLE	ND	NO SAMPLE	900	5000
VW-11	ND	NO SAMPLE	ND	NO SAMPLE	8200	14,000
VW-12	41	NO SAMPLE	ND	NO SAMPLE	ND	ND
VW-13	ND	NO SAMPLE	ND	NO SAMPLE	ND	16,000
VW-14	270	85	110	780	30,800	10,500
VW-15	190	NO SAMPLE	ND	NO SAMPLE	18,700	NO SAMPLE
VW-16	ND	NO SAMPLE	ND	NO SAMPLE	ND	ND
VW-17	ND	NO SAMPLE	ND	NO SAMPLE	ND	ND
VW-18	ND	2000	ND	ND	ND	40,000
VW-19	ND	NO SAMPLE	ND	NO SAMPLE	ND	NO SAMPLE
VW-20	ND	NO SAMPLE	ND	NO SAMPLE	ND	ND
VW-21	ND	NO SAMPLE	ND	NO SAMPLE	ND	ND
VW-22	ND	NO SAMPLE	ND	NO SAMPLE	ND	ND
VW-23	ND	NO SAMPLE	ND	NO SAMPLE	ND	5000
VW-24	ND	NO SAMPLE	ND	NO SAMPLE	ND	ND
VW-25	ND	NO SAMPLE	ND	NO SAMPLE	2900	185,000
VW-26	ND	NO SAMPLE	ND	NO SAMPLE	ND	ND

^aND = Not Detected

^bBoldface indicates an increase in concentration relative to 1989 sampling.

Figure 2-7
LAND USE MAP
WASTE DISPOSAL INC.

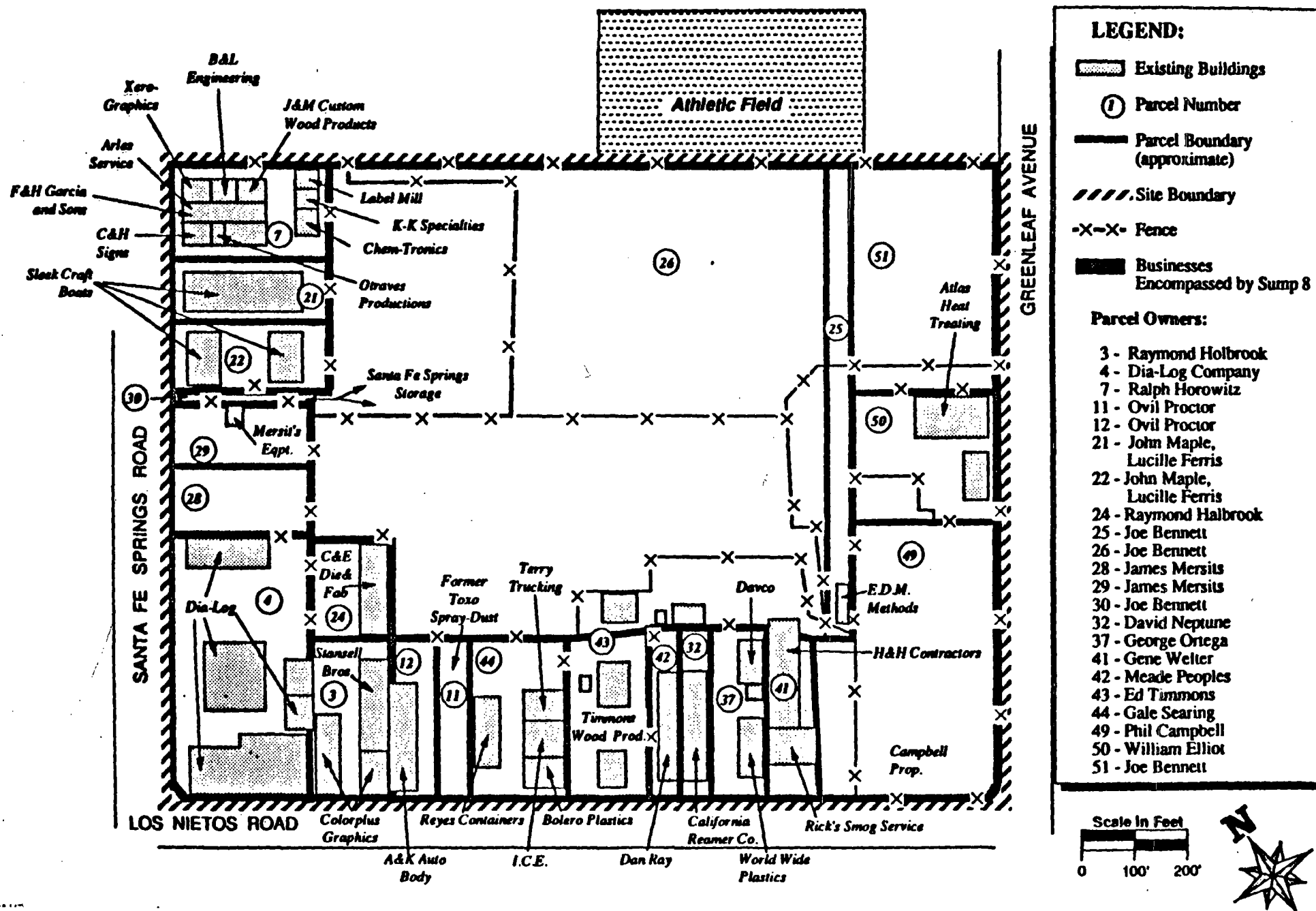


Figure 3-8
LOCATIONS OF WASTE HANDLING AREAS
Waste Disposal, Inc.

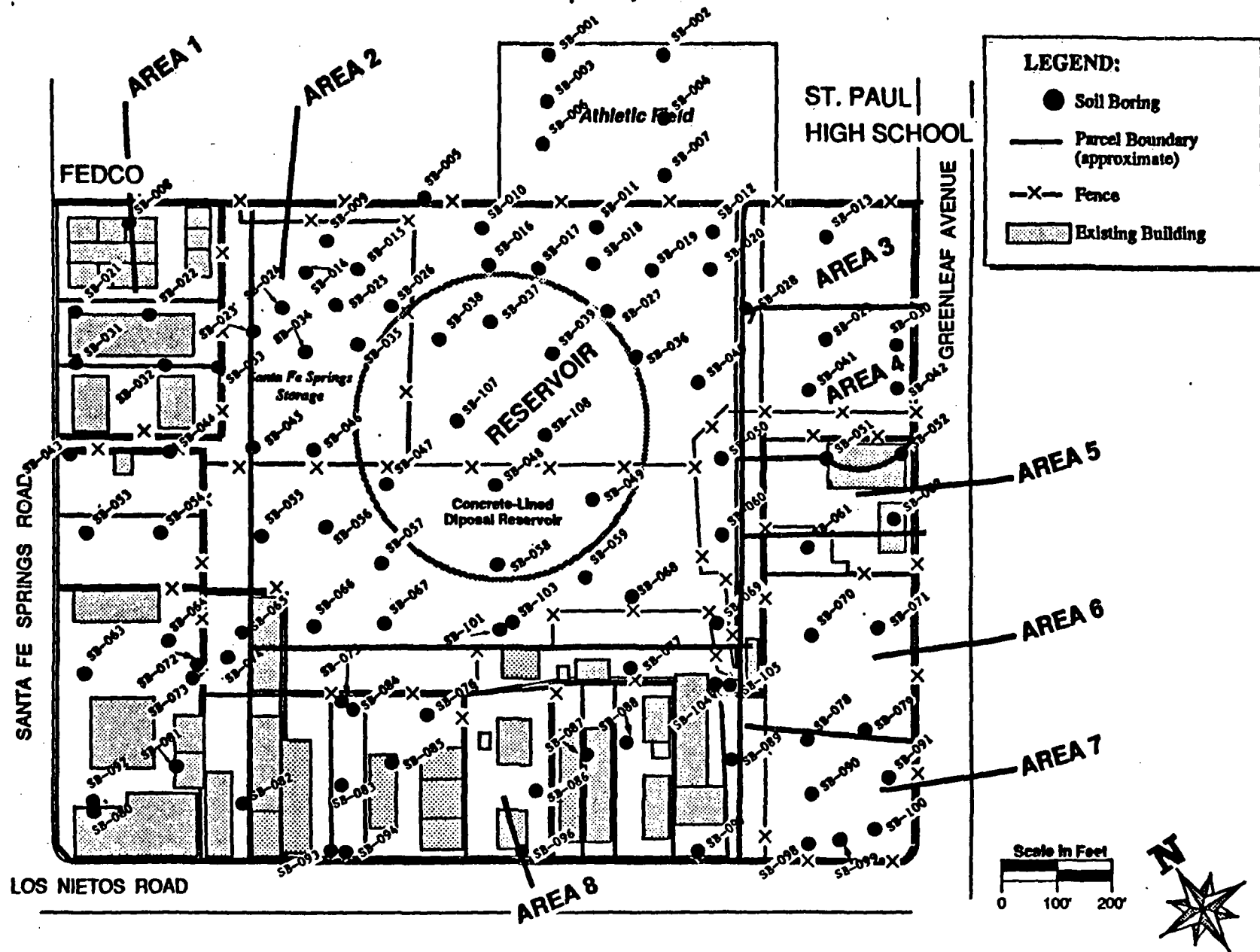


TABLE 4-4

METALS CONCENTRATIONS COMPARED TO BACKGROUND
WDI RESERVOIR/WASTE HANDLING AREAS

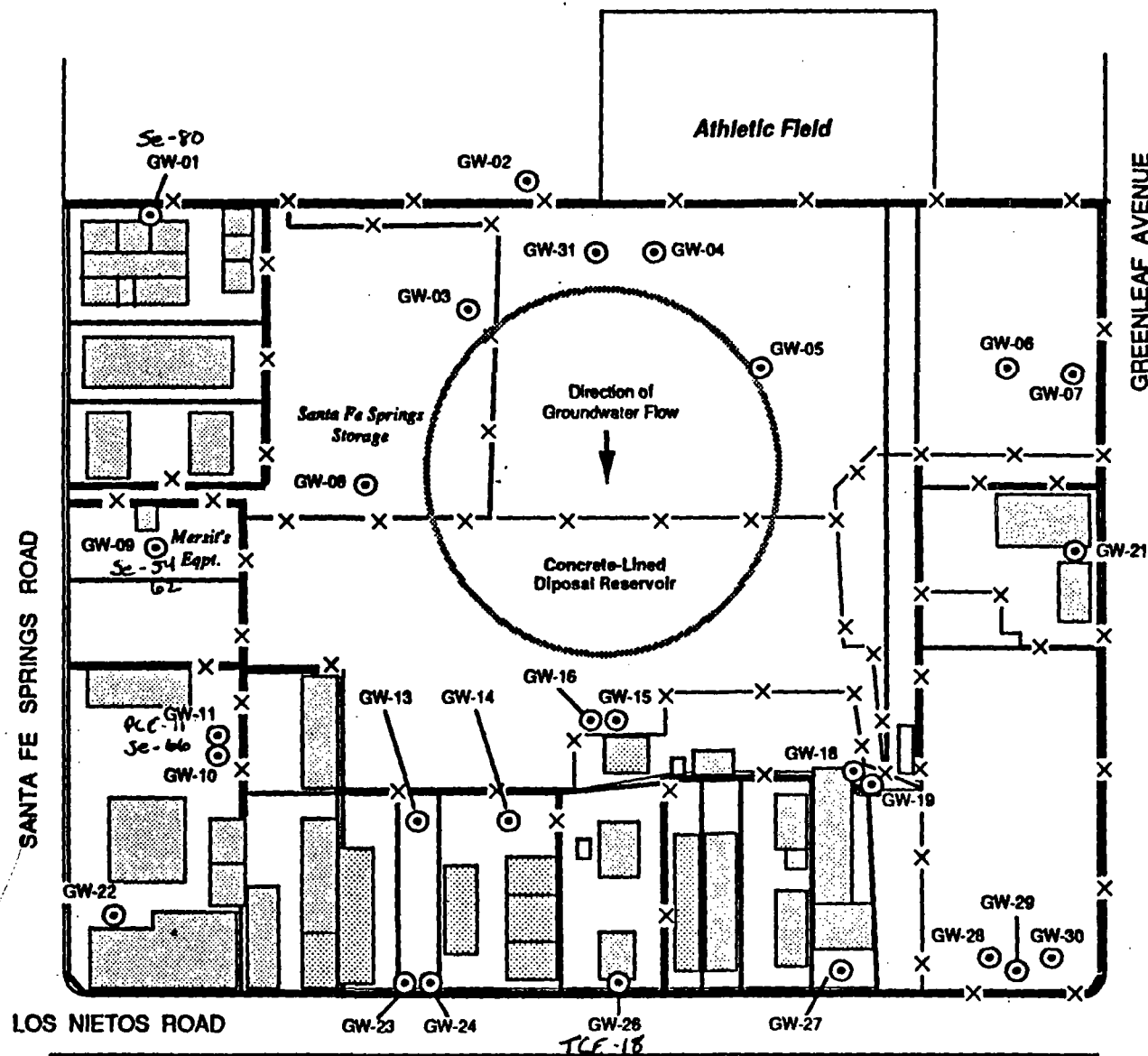
Metals	Background Concentrations (mg/kg)	Frequency of Detects (%)	Minimum (ppm)	Maximum (ppm)	Median (ppm)	Standard Deviation (ppm)	Arithmetic Mean (ppm)	Geometric Mean (ppm)	STLC Values (ppm)	TTLC Values (ppm)
Aluminum, Al	3,450.00 - 10,300.00	100.00	3,000	39,600	12,600	6,867	12,954	10,969	b	c
Antimony, Sb	2.70 - 3.00	49.82	2	173	4.65	14.62	6.08	4.43	15.00	500.00
Arsenic, As	1.68 - 2.31	100.00	.71	337	5.45	21.91	8.74	5.36	5.36	500.00
Barium, Ba	37.50 - 71.10	100.00	29.8	4,450	150	506.22	267.55	145.36	100.00	10,000.00
Beryllium, Be	0.196 - 0.278	85.66	0.13	1.4	0.35	0.35	0.55	0.42	0.75	75.00
Cadmium, Cd	0.255 - 0.363	57.04	0.19	50.1	0.68	4.62	1.45	0.71	1.00	100.00
Calcium, Ca	1,360.0 - 1,870.0	100.00	1,280	92,400	4,285	12,837	8,986	5,208	b	c
Chromium, Cr	5.96 - 12.10	100.00	4.63	149	22.75	15.14	23.68	19.53	560.00	2,500.00
Cobalt, Co	3.00 - 7.17	99.64	2.46	31.8	11.25	5.44	11.17	9.67	80.00	8,000.00
Copper, Cu	4.95 - 13.80	99.29	3.44	721	24.1	64.98	35.37	22.3	25.00	2,500.00
Iron, Fe	6,130.00 - 13,700.00	100.00	5,350	61,600	20,600	8,974	20,170	17,890	b	c
Lead, Pb	3.33 - 7.00	99.64	1.5	2,790	7.3	305	82.55	11.59	5.00	1,000.00
Magnesium, Mg	1,660.00 - 3,220.00	100.00	1,440	27,200	5,985	3,380	6,193	5,307	b	c
Manganese, Mn	88.80 - 263.00	100.00	71.8	2,270	342	271.5	393.86	325.21	b	c
Mercury, Hg	0.018 - 0.0137	72.86	0.01	10.9	0.11	0.79	0.21	0.09	0.20	20.00
Molybdenum, Mo	0.194 - 0.268	47.65	0.19	33.4	0.55	3.01	1.24	0.72	350.00	3,500.00
Nickel, Ni	4.05 - 9.23	100.00	3.61	105	18.9	11.43	18.62	15.34	20.00	2,000.00
Potassium, K	818.00 - 2260.00	100.00	495	13,600	3,490	1,664	3,266	2,770	b	c
Selenium, Se	0.202 - 0.278	48.01	0.13	1.2	0.26	0.24	0.36	0.31	1.00	100.00
Silver, Ag	0.863 - 0.939	45.49	0.42	4.8	0.81	0.63	0.90	0.80	5.00	500.00
Sodium, Na	123.00 - 231.00	87.32	88.7	6,650	465	955.05	781.59	486.03	b	c
Thallium, Tl	9.77 - 12.00	41.52	0.55	39.2	12.6	5.77	14.34	13.07	7.00	700.00
Vanadium, V	10.60 - 27.30	100.00	9.33	107	40.3	17.55	38.80	34.11	24.00	2,400.00
Zinc, Zn	22.10 - 38.30	100.00	14	775	61.6	93.15	81.77	58.56	250.00	5,000.00

^a Neither the waste extraction test (WET) to determine the STLC nor the EP Toxicity test have been conducted on WDI soil samples at this time. These values are provided for reference purposes only. Generally, if the concentration of a metal is 10 times the STLC or EP Toxicity test in soil it can be considered likely to occur in hazardous concentrations in leachate.

^b Soluble Threshold Limit Concentrations (STLC) values have not been established for these metals under Title 22 of the California Code of Regulations (CCR).

^c Total Threshold Limit Concentrations (TTLC) values have not been established for these metals under Title 22 of the California Code of Regulations (CCR).

Figure 2-3
GROUNDWATER MONITORING
WELL LOCATIONS
Waste Disposal, Inc.



LEGEND:

⊙ Groundwater Monitoring Well Locations

Existing Buildings

Parcel Boundary (approximate)

-X-X- Fence

Scale in Feet
0 100' 200'



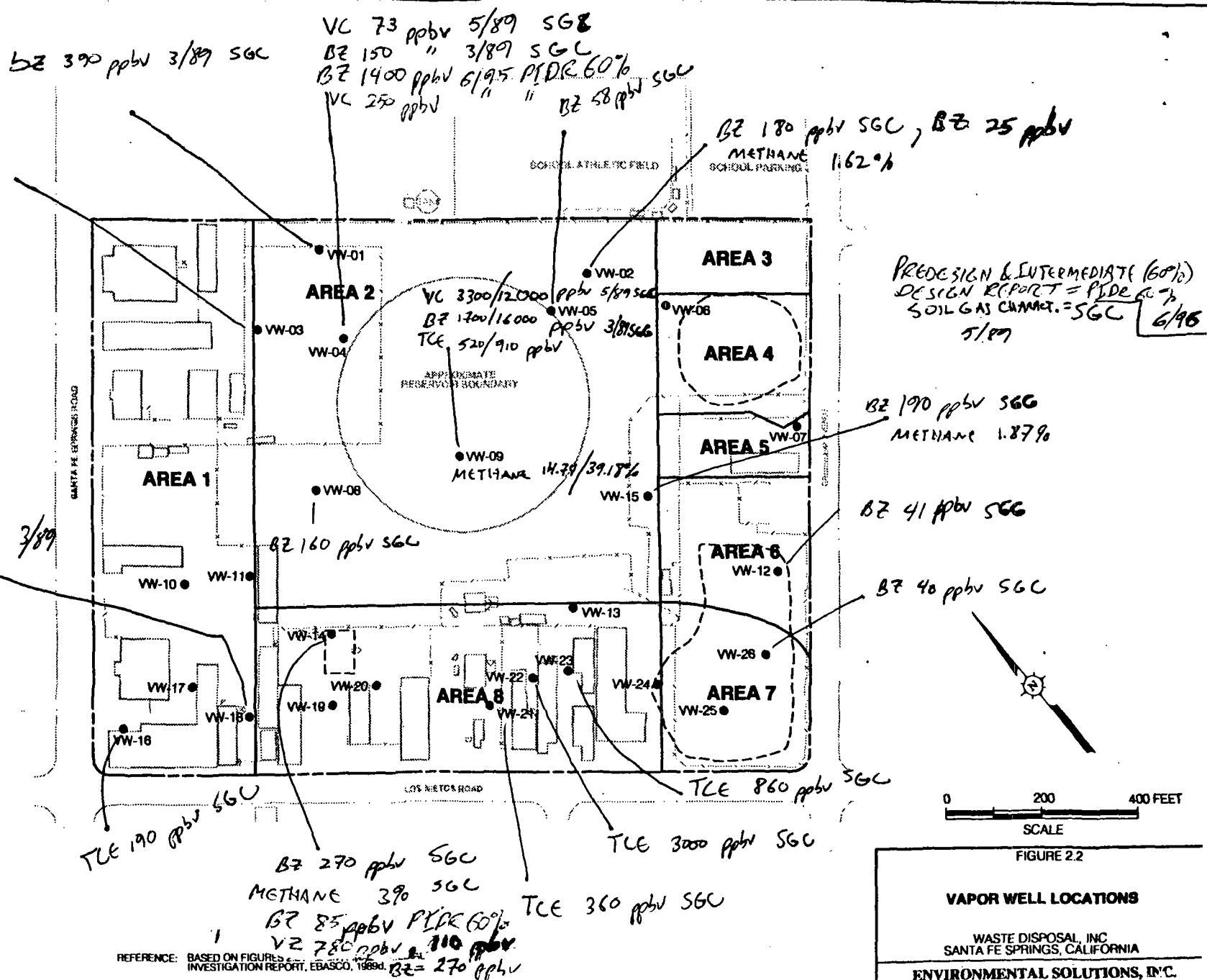


TABLE 4-5
VOLATILE ORGANIC COMPOUNDS (VOC) CONCENTRATIONS
WDI RESERVOIR/WASTE-HANDLING AREA

Compound	Depth	Number of Detects	Number of Samples	Frequency of Detects (%)	STLC Values (mg/l)	Minimum (ppb)	Maximum (ppb)	Median (ppb)	Standard Deviation (ppb)	Arithmetic Mean (ppb)	Geometric Mean (ppb)
1,1,1-Trichloroethane	5,10,15,20,30,35	13	304	4.28	a	3	1,800	9	733.46	512.54	45.98
1,1,2,2-Trichloroethane	20	1	58	1.72	a	28	28	28	0	28.00	28.00
1,1,2-Trichloroethane	20	1	60	1.67	a	16	16	16	0	16	16
1,1-Dichloroethene	5,10,20,35	4	240	1.67	a	2	1,200	34.5	588.93	317.75	26.26
1,2-Dichloroethene	0,10,15,20	4	204	1.96	a	1.7	14	8.5	6.23	8.18	5.93
1,2-Dichloropropane	20	1	60	1.67	a	17	17	17	0	17	17
2-Butanone	0-50	93	398	23.37	a	1	11,000	12	1,139.02	148.03	14.41
2-Hexanone	10	1	62	1.61	a	3	3	3	0.00	3.00	3.00
4-Methyl-2-Pentanone	0,5,10,20	8	226	3.54	a	1	68	4.5	23.00	14.13	5.56
Acetone ^b	0-50	70	263	26.62	a	1	4,100	38.5	514.83	173.14	46.22
Benzene ^c	0-35	36	412	8.74	a	0	19,000	195	4,099.00	2,200.00	97.00
Benzyl Alcohol	35	1	68	1.47	a	89	89	89	0	89.00	89.00
Carbon Disulfide	5,10,15	4	152	2.63	a	1	10	5.5	3.87	5.5	4.09
Carbon Tetrachloride	10	1	62	1.61	a	2	2	2	0.00	2.00	2.00
Chlorobenzene	20	2	60	3.33	a	18	70	44	36.67	44.00	35.50
Chloroform	0-25	10	263	3.80	a	1	5	2	1.25	2.00	1.73
Chloromethane	5	1	48	2.08	a	2	2	2	0	2	2
Ethylbenzene ^c	0-35,50	67	418	16.03	a	1	73,000	230	10,886.19	4,995.87	202.12
Methylene Chloride ^b	0-50	82	250	32.80	a	1	2,400	8	386.00	140.00	14.00
Styrene	10,20	5	124	4.03	a	1	650	17	282.39	145.60	23.89
Tetrachloroethene	5-20	9	213	4.23	a	2	43,000	6	14,286.31	4,917.67	25.68
Toluene ^{b,c}	0-50,60	232	442	52.49	a	0.3	120,000	36.5	9,546.05	1,853.43	42.41
Trichloroethene ^c	10,15,20,35	7	235	2.98	204	1	5,000	21	1,859.90	806.43	28.67
Vinyl Acetate	0,40,45	3	65	4.62	a	9	76	64	35.73	49.67	35.24
Vinyl Chloride	10,15	3	110	2.73	a	1	1,700	18	976.00	573.00	31.00
Xylene ^c	0-35,60	52	410	12.68	a	2	410,000	515	71,250.61	24,236.68	441.93

^a STLC Values have not been established for these chemicals under Title 22 of the California Code of Regulations (CCR).

^b Common laboratory contaminant.

^c Constituents commonly found in total petroleum hydrocarbon.

TABLE 4-6

SEMI-VOLATILE ORGANICS CONCENTRATIONS
WDI RESERVOIR/WASTE-HANDLING AREAS

Compound	Depth	Number of Detects	Number of Samples	Frequency of Detects (%)	STLC Values (mg/l)	Minimum (ppb)	Maximum (ppb)	Median (ppb)	Standard Deviation (ppb)	Arithmetic Mean (ppb)	Geometric Mean (ppb)
1,2,4-Trichlorobenzene	0,10,20,30	5	193	2.59	a	35	2,600	98	1,114.89	611.00	174.22
1,2-Dichlorobenzene	5,10,20	4	170	2.35	a	3	1,600	203.5	753.30	502.50	75.11
1,3-Dichlorobenzene	10	1	60	1.67	a	24	24	24	0.00	24.00	24.00
1,4-Dichlorobenzene	5,10,20	5	156	3.21	a	6	2,400	160	1,009.00	687.00	165.00
2,4-Dinitrotoluene	10	1	57	1.75	a	130	130	130	0.00	130.00	130.00
2,6-Dinitrotoluene	10	1	59	1.69	a	360	360	360	0.00	360.00	360.00
2-Chloronaphthalene	20	1	56	1.79	a	20	20	20	0.00	20.00	20.00
2-Chlorophenol	20,30	3	83	3.61	a	71	5,200	160	2,395.87	1,810.33	389.46
2-Methylnaphthalene	0-35,45,50,60	83	440	18.86	a	2	170,000	1200	32,293.77	14,573.77	1099.56
2-Methylphenol	0	1	50	2.00	a	79	79	79	0.00	79.00	79.00
3,3-Dichlorobenzidine	5,10	2	100	2.00	a	93	100	96.5	4.95	96.5	96.44
4-Chloro-3-methylphenol	0,10,20,30,35	6	260	2.31	a	73	5,300	145	2,107.60	1,000.00	234.58
4-Chloroaniline	5	1	48	2.08	a	140	140	140	0.00	140.00	140.00
4-Methylphenol	0,15,35	4	158	2.53	a	110	1200	715	451.70	685.00	507.87
4-Nitroaniline	5	1	46	2.17	a	82	82	82	0	82	82
4-Nitrophenol	35	5	136	3.68	a	80	1,700	780	582.05	806.00	562.57
Acenaphthene	0-30,50	14	305	4.59	a	2.7	2,300	130	914.56	669.98	151.65
Acenaphthylene	5,10,35	4	158	2.53	a	18	170	77.5	63.00	85.75	65.36
Anthracene	0-20	12	272	4.41	a	5	16,000	171	4,525.00	1,731.00	161.00
Benzo(a)anthracene	0,5,10,15,20	13	303	4.29	a	27	1,500	360	430.00	446.00	274.00
Benzo(a)pyrene	0-20,35	16	373	4.29	a	18	1,500	205	399.65	365.88	212.03
Benzo(b)fluoranthene	0-10,35	10	252	3.97	a	45	2,200	325	626.61	470.50	283.85
Benzo(g,h,i)perylene	0-10,35	8	228	3.51	a	51	660	170	252.27	288.63	191.00
Benzo(k)fluoranthene	0-10	5	152	3.29	a	48	410	120	162.07	201.80	148.85
Benzoic Acid	0-10,25,35	11	288	3.82	a	69	1,700	100	568.31	320.36	174.34
Butylbenzylphthalate	0,5,20,30,40,60	12	192	6.25	a	18	17,000	195	4,831.11	1,885.95	259.36
Chrysene	0-35	40	419	9.55	a	2	8,000	285	1,688.00	871.00	234.00

TABLE 4-6
SEMI-VOLATILE ORGANICS CONCENTRATIONS
WDI RESERVOIR/WASTE-HANDLING AREAS
(Continued)

Compound	Depth	Number of Detects	Number of Samples	Frequency of Detects (%)	STLC Values (mg/l)	Minimum (ppb)	Maximum (ppb)	Median (ppb)	Standard Deviation (ppb)	Arithmetic Mean (ppb)	Geometric Mean (ppb)
Di-n-butylphthalate	0-35	37	369	10.03	a	4	8,600	220	1,414.66	619.54	238.48
Di-n-octylphthalate	0-25,35	15	356	4.21	a	31	88,000	120	22,681.89	6,011.67	165.20
Dibenzofuran	0-20	9	251	3.59	a	3	1,300	280	435.67	383.78	98.06
Dibenz(a,h)anthracene	5,10	2	100	2.00	a	16	42	29	18.38	29	25.92
Diethylphthalate	15,35	3	105	2.86	a	22	360	48	188.09	143.33	72.44
Dimethylphthalate	0	1	50	2.00	a	1000	1,000	1,000	0	1,000.00	1,000.00
Fluoranthene	0-20	24	307	7.82	a	2.1	1,500	170	441.40	369.68	115.92
Fluorene	0-35	43	391	11.00	a	2	18,000	250	3,856.00	2,168.00	269.00
Hexachloroethane	15	1	40	2.50	a	280	280	280	0	280.00	280.00
Ideno(1,2,3-cd)pyrene	5,10,35	5	176	2.84	a	58	450	89	163.96	174.20	128.01
Isophorone	0,10,15	3	75	2.67	a	62	3,200	150	1,787.00	1,137.00	310.00
N-Nitrosodiphenylamine	5-15,25,30,35	7	250	2.80	a	90	4,000	950	1,326.00	1,247.00	731.00
Naphthalene	0-35,45,50,60	62	439	14.12	a	3.3	52,000	665	11,913.74	6,261.49	681.55
Nitrobenzene	10	1	57	1.75	a	20	20	20	0.00	20.00	20.00
Pentachlorophenol	0-10,30,35	7	238	2.94	a	180	340	230	59.64	257.14	251.26
Phenanthrene	0-35,45,50	67	422	15.88	a	5	44,000	550	8,959.50	4,341.60	552.04
Phenol	0,15,20	4	152	2.63	a	51	4,800	2800	2,057.00	2,613.00	1,152.00
Pyrene	0-35,60	41	424	9.67	a	2.5	4,300	180	941.35	623.63	164.57
bis(2-Ethylhexyl)phthalate	0-35	61	335	18.21	a	4	830,000	150	106,219.00	14,028.00	195.00

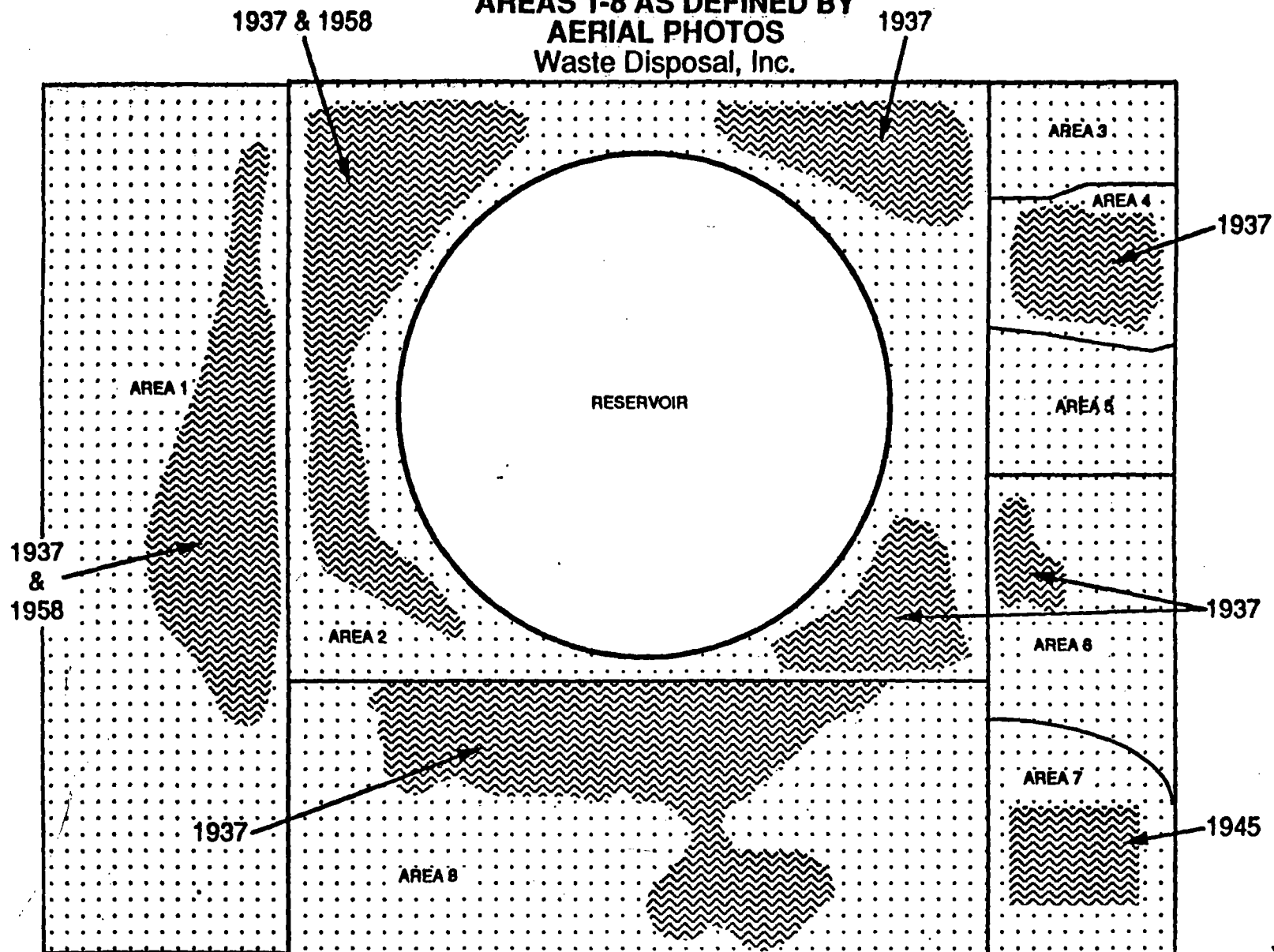
^a STLC values have not been established for these chemicals under Title 22 of the California Code of Regulations (CCR).

TABLE 2-6
SUBSURFACE GAS SAMPLE RESULTS
COLLECTED AT THE WDI SITE

Chemical	CONCENTRATION (in ug/m3)						
	Detection Frequency	Total Samples	Geometric Mean (a)	Geometric Mean (b)	Maximum	Detection Limit	Blank Geometric Mean (c)
Benzene	38%	26	99	524	28,000	64	67
Carbon Tetrachloride	3.8%	26	1.7	9.4	9.4	3.1	ND (d)
Chloroform	15%	26	3.8	45	120	4.9	ND
1,2-Dibromoethane	81%	26	160	209	590	110	210
1,2-Dichloroethane	3.8%	26	42	117	120	81	ND
Tetrachloroethylene	100%	26	88	88	520	6.8	30
1,1,1-Trichloroethane	50%	26	44	130	6,300	27	39
Trichloroethylene	92%	26	150	215	16,000	5.4	9.1
Vinyl Chloride	12%	26	38	945	20,000	51	ND

- (a) - Geometric mean using all positively detected samples and one half the detection limit for non-detected samples.
 (b) - Geometric mean using positive detects only.
 (c) - Two blank samples were collected.
 (d) - ND - Not detected in either blank sample.

Figure 3-9
**WASTE HANDLING
 AREAS 1-8 AS DEFINED BY
 AERIAL PHOTOS**
 Waste Disposal, Inc.



LEGEND: DATES REFER TO YEAR OF
 AVAILABLE AERIAL PHOTO



Standing Liquid



Extent of Area



Approx. Scale 1" = 200'

TABLE 4-9

CHEMICAL CONCENTRATIONS OF COMPOUNDS
OF CONCERN IN THE RESERVOIR AREA

Analyte	No. of Samples	No. of Detects	Frequency (%) of Detects	Min.	Max.	Average
● Metals				(ppm)	(ppm)	(ppm)
Arsenic	41	41	100	1.80	337.00	23.20
Cadmium	41	22	51	0.39	18.20	2.30
Chromium	41	41	100	8.26	149.00	34.67
Copper	41	41	100	7.30	721.00	57.45
Lead	41	41	100	4.80	23,000.00	822.20
Mercury	41	29	71	0.02	10.90	0.61
Selenium	41	17	41	0.20	0.87	0.41
● Volatile Organics				(ppb)	(ppb)	(ppb)
2-Butanone	38	5	13	1.00	13.00	6.00
Acetone	28	7	25	1.00	4,100.00	779.00
Benzene	47	15	32	1.80	19,000.00	3,727.00
Chloroform	41	0	0	N/A	N/A	N/A
Ethylbenzene	52	26	50	1.20	73,000.00	7,895.00
Methylene Chloride	26	12	46	1.00	1,200.00	249.00
Toluene	44	35	79	0.80	120,000.00	8,189.00
Xylene (total)	49	24	49	4.10	410,000.00	38,594.00
● Pesticides and PCB's				(ppb)	(ppb)	(ppb)
4,4'-DDD	43	4	9	2.00	28.00	10.60
4,4'-DDE	43	4	9	4.00	44.00	17.80
4,4'-DDT	43	4	9	15.00	72.00	43.80
Aldrin	43	0	0	N/A	N/A	N/A
Aroclor-1016	41	0	0	N/A	N/A	N/A
Aroclor-1221	41	0	0	N/A	N/A	N/A
Aroclor-1232	41	0	0	N/A	N/A	N/A
Aroclor-1242	41	0	0	N/A	N/A	N/A
Aroclor-1248	50	1	2	22.00	22.00	22.00
Aroclor-1254	41	3	14	86.00	570.00	329.00
Aroclor-1260	46	3	7	100.00	3,200.00	1,533.00
Dieldrin	43	1	2	7.80	7.80	7.80
Heptachlor	43	0	0	N/A	N/A	N/A
Heptachlor epoxide	43	2	5	2.50	46.00	24.30
Toxaphene	41	0	0	N/A	N/A	N/A
alpha-BHC	43	0	0	N/A	N/A	N/A
alpha-Chlordane	43	2	5	9.10	210.00	110.00
beta-BHC	43	0	0	N/A	N/A	N/A
delta-BHC	43	0	0	N/A	N/A	N/A
gamma-BHC (Lindane)	43	0	0	N/A	N/A	N/A
gamma-Chlordane	43	2	5	12.00	270.00	141.00
● Semi-Volatiles Organics				(ppb)	(ppb)	(ppb)
Acenaphthene	50	9	18	2.70	2,300.00	504.00
Acenaphthylene	49	1	2	18.00	18.00	18.00
Anthracene	50	6	12	5.00	260.00	65.00
Benzo(a)anthracene	50	2	4	27.00	600.00	314.00
Benzo(a)pyrene	50	2	4	18.00	280.00	149.00
Benzo(b)fluoranthene	44	2	5	310.00	410.00	360.00
Benzo(g,h,i)perylene	44	1	2	560.00	560.00	560.00
Benzo(k)fluoranthene	44	2	5	340.00	410.00	375.00
Benzoic Acid	44	3	7	100.00	1,700.00	640.00
Chrysene	50	9	18	2.20	7,400.00	1,219.00
Di-n-butylphthalate	49	4	8	4.00	230.00	84.00
Di-n-octylphthalate	44	1	2	630.00	630.00	630.00
Dibenz(a,h)anthracene	44	0	0	N/A	N/A	N/A
Fluoranthene	50	10	20	2.30	1,300.00	466.00
Fluorene	52	17	33	2.00	8,100.00	1,315.00
Indeno(1,2,3-cd)pyrene	44	0	0	N/A	N/A	N/A
Naphthalene	52	23	44	3.30	52,000.00	8,567.00
Pentachlorophenol	44	0	0	N/A	N/A	N/A
Phenanthrene	51	25	49	5.70	44,000.00	6,195.00
Pyrene	51	12	24	3.20	2,900.00	860.00
bis(2-ethylhexyl)phthalate	40	13	33	3.60	2,100.00	354.00

TABLE 4-10
CHEMICAL CONCENTRATIONS OF COMPOUNDS
OF CONCERN IN AREA 1

Analyte	No. of Samples	No. of Detects	Frequency (%) of Detects	Min.	Max.	Average
● Metals				(ppm)	(ppm)	(ppm)
Arsenic	28	28	100	1.08	20.70	7.22
Cadmium	21	21	75	0.19	50.10	4.05
Chromium	28	28	100	4.63	44.10	22.16
Copper	28	28	100	4.14	507.00	41.33
Lead	28	28	100	2.56	75.60	10.59
Mercury	25	25	89	0.02	0.63	0.10
Selenium	21	21	75	0.18	0.52	0.26
● Volatile Organics				(ppb)	(ppb)	(ppb)
2-Butanone	80	27	34	3.00	100.00	26.10
Acetone	53	8	15	11.00	150.00	70.00
Benzene	64	0	0	N/A	N/A	N/A
Chloroform	64	5	8	1.00	3.00	1.60
Ethylbenzene	63	0	0	N/A	N/A	N/A
Methylene Chloride	59	15	25	2.00	13.00	7.90
Toluene	77	36	47	1.00	2300.00	112.90
Xylene (total)	64	1	2	24.00	24.00	24.00
● Pesticides and PCB's				(ppb)	(ppb)	(ppb)
4,4'-DDD	79	6	8	3.00	36.00	15.40
4,4'-DDE	79	6	8	0.80	13.00	6.50
4,4'-DDT	75	1	1	36.00	36.00	36.00
Aldrin	63	0	0	N/A	N/A	N/A
Aroclor-1016	63	0	0	N/A	N/A	N/A
Aroclor-1221	63	0	0	N/A	N/A	N/A
Aroclor-1232	63	0	0	N/A	N/A	N/A
Aroclor-1242	63	0	0	N/A	N/A	N/A
Aroclor-1248	63	0	0	N/A	N/A	N/A
Aroclor-1254	63	0	0	N/A	N/A	N/A
Aroclor-1260	63	0	0	N/A	N/A	N/A
Dieldrin	63	0	0	N/A	N/A	N/A
Heptachlor	63	2	3	2.00	3.00	2.50
Heptachlor epoxide	63	0	0	N/A	N/A	N/A
Toxaphene	63	0	0	N/A	N/A	N/A
alpha-BHC	63	0	0	N/A	N/A	N/A
alpha-Chlordane	63	1	2	300.00	300.00	300.00
beta-BHC	63	0	0	N/A	N/A	N/A
delta-BHC	63	0	0	N/A	N/A	N/A
gamma-BHC (Lindane)	63	2	3	7.00	15.00	11.00
gamma-Chlordane	79	6	8	1.00	450.00	77.00
● Semi-Volatiles Organics				(ppb)	(ppb)	(ppb)
Acenaphthene	64	0	0	N/A	N/A	N/A
Acenaphthylene	62	0	0	N/A	N/A	N/A
Anthracene	64	2	3	1,000.00	1,600.00	1,300.00
Benzo(a)anthracene	80	3	4	76.00	530.00	302.00
Benzo(a)pyrene	80	3	4	55.00	750.00	428.30
Benzo(b)fluoranthene	80	0	0	N/A	N/A	N/A
Benzo(g,h,i)perylene	64	1	2	51.00	51.00	51.00
Benzo(k)fluoranthene	64	0	0	N/A	N/A	N/A
Benzoic Acid	64	2	3	89.00	1,300.00	694.50
Chrysene	80	7	9	88.00	620.00	306.80
Di-n-butylphthalate	67	4	6	77.00	570.00	399.30
Di-n-octylphthalate	80	5	6	31.00	210.00	108.60
Dibenz(a,h)anthracene	64	2	3	16.00	42.00	29.00
Fluoranthene	80	2	3	96.00	260.00	178.00
Fluorene	64	4	6	190.00	260.00	235.00
Indeno(1,2,3-cd)pyrene	64	1	2	58.00	58.00	58.00
Naphthalene	64	3	5	240.00	440.00	333.30
Pentachlorophenol	64	1	2	220.00	220.00	220.00
Phenanthrene	64	4	6	810.00	1,700.00	1,117.50
Pyrene	80	4	5	59.00	260.00	154.80
bis(2-ethylhexyl)phthalate	66	8	12	68.00	5,800.00	917.30

TABLE 4-11
CHEMICAL CONCENTRATIONS OF COMPOUNDS
OF CONCERN IN AREA 2

Analyte	No. of Samples	No. of Detects	Frequency (%) of Detects	Min.	Max.	Average
				(ppm)	(ppm)	(ppm)
● Metals						
Arsenic	65	65	100	1.17	68.70	8.96
Cadmium	65	42	65	0.21	3.30	1.00
Chromium	65	65	100	5.20	75.70	24.22
Copper	65	64	98	3.44	243.00	35.08
Lead	65	65	100	1.60	1,140.00	95.93
Mercury	65	49	75	0.02	2.00	0.18
Selenium	61	30	49	0.18	1.10	0.36
				(ppb)	(ppb)	(ppb)
● Volatile Organics						
2-Butanone	79	20	25	2.00	11,000.00	585.00
Acetone	61	16	26	3.00	780.00	178.20
Benzene	93	8	9	0.20	4,200.00	1,152.90
Chloroform	74	0	0	N/A	N/A	N/A
Ethylbenzene	91	15	16	2.00	240,000.00	4,673.70
Methylene Chloride	58	16	28	1.00	430.00	73.00
Toluene	87	54	62	0.30	39,000.00	1,721.20
Xylene (total)	92	11	12	2.00	140,000.00	25,285.00
				(ppb)	(ppb)	(ppb)
● Pesticides and PCB's						
4,4'-DDD	83	2	2	62.00	90.00	76.00
4,4'-DDE	88	2	2	31.00	73.00	52.00
4,4'-DDT	80	6	8	4.00	160.00	44.30
Aldrin	88	1	1	23.00	23.00	23.00
Aroclor-1016	73	0	0	N/A	N/A	N/A
Aroclor-1221	73	0	0	N/A	N/A	N/A
Aroclor-1232	73	0	0	N/A	N/A	N/A
Aroclor-1242	73	0	0	N/A	N/A	N/A
Aroclor-1248	77	3	4	72.00	23,000.00	14,024.00
Aroclor-1254	73	3	4	31.00	140.00	97.00
Aroclor-1260	76	2	3	140.00	530.00	335.00
Dieldrin	74	0	0	N/A	N/A	N/A
Heptachlor	74	0	0	N/A	N/A	N/A
Heptachlor epoxide	74	0	0	N/A	N/A	N/A
Toxaphene	76	0	0	N/A	N/A	N/A
alpha-BHC	74	0	0	N/A	N/A	N/A
alpha-Chlordane	74	3	4	1.30	11.00	5.90
beta-BHC	74	0	0	N/A	N/A	N/A
delta-BHC	74	0	0	N/A	N/A	N/A
gamma-BHC (Lindane)	74	0	0	N/A	N/A	N/A
gamma-Chlordane	75	2	3	0.10	6.00	3.10
				(ppb)	(ppb)	(ppb)
● Semi-Volatiles Organics						
Acenaphthene	78	1	1	83.00	83.00	83.00
Acenaphthylene	77	2	3	20.00	84.00	52.00
Anthracene	86	2	2	53.00	1,100.00	576.50
Benzo(a)anthracene	92	4	4	360.00	1,100.00	590.00
Benzo(a)pyrene	92	3	3	290.00	1,500.00	756.70
Benzo(b)fluoranthene	89	3	3	350.00	2,200.00	1,040.00
Benzo(g,h,i)perylene	83	3	4	110.00	660.00	333.30
Benzo(k)fluoranthene	75	0	0	N/A	N/A	N/A
Benzoic Acid	75	3	4	83.00	230.00	137.70
Chrysene	92	8	9	2.30	2,600.00	718.50
Di-n-butylphthalate	79	12	15	44.00	8,600.00	1,278.70
Di-n-octylphthalate	76	1	1	36.00	36.00	36.00
Dibenz(a,h)anthracene	75	0	0	N/A	N/A	N/A
Fluoranthene	95	5	5	2.10	1,500.00	578.40
Fluorene	86	9	10	2.60	13,000.00	2,732.00
Indeno(1,2,3-cd)pyrene	83	2	2	200.00	450.00	325.00
Naphthalene	94	20	21	7.90	42,000.00	5,798.60
Pentachlorophenol	75	3	4	180.00	320.00	263.30
Phenanthrene	94	23	24	5.00	25,000.00	3,230.10
Pyrene	95	9	9	2.50	4,300.00	1,105.20
bis(2-ethylhexyl)phthalate	79	7	9	91.00	1,600.00	533.00

TABLE 4-12
CHEMICAL CONCENTRATIONS OF COMPOUNDS
OF CONCERN IN AREA 3

Analyte	No. of Samples	No. of Detects	Frequency (%) of Detects	Min.	Max.	Average
				(ppm)	(ppm)	(ppm)
● Metals						
Arsenic	4	4	100	1.89	2.89	2.34
Cadmium	4	4	100	0.25	0.83	0.45
Chromium	4	4	100	6.42	17.70	13.28
Copper	4	4	100	5.82	17.00	11.54
Lead	4	4	100	2.34	15.60	7.15
Mercury	4	4	100	0.02	0.06	0.04
Selenium	4	4	100	0.21	0.24	0.23
				(ppb)	(ppb)	(ppb)
● Volatile Organics						
2-Butanone	7	6	86	9.00	100.00	54.00
Acetone	7	3	43	33.00	240.00	105.30
Benzene	7	0	0	N/A	N/A	N/A
Chloroform	3	1	33	2.00	2.00	2.00
Ethylbenzene	7	0	0	N/A	N/A	N/A
Methylene Chloride	5	0	0	N/A	N/A	N/A
Toluene	7	3	43	62.00	150.00	114.00
Xylene (total)	7	0	0	N/A	N/A	N/A
				(ppb)	(ppb)	(ppb)
● Pesticides and PCB's						
4,4'-DDD	3	0	0	N/A	N/A	N/A
4,4'-DDE	7	0	0	N/A	N/A	N/A
4,4'-DDT	7	0	0	N/A	N/A	N/A
Aldrin	3	0	0	N/A	N/A	N/A
Aroclor-1016	3	0	0	N/A	N/A	N/A
Aroclor-1221	3	0	0	N/A	N/A	N/A
Aroclor-1232	3	0	0	N/A	N/A	N/A
Aroclor-1242	3	0	0	N/A	N/A	N/A
Aroclor-1248	3	0	0	N/A	N/A	N/A
Aroclor-1254	3	0	0	N/A	N/A	N/A
Aroclor-1260	3	0	0	N/A	N/A	N/A
Dieldrin	3	0	0	N/A	N/A	N/A
Heptachlor	3	0	0	N/A	N/A	N/A
Heptachlor epoxide	3	0	0	N/A	N/A	N/A
Toxaphene	3	0	0	N/A	N/A	N/A
alpha-BHC	3	0	0	N/A	N/A	N/A
alpha-Chlordane	3	0	0	N/A	N/A	N/A
beta-BHC	3	0	0	N/A	N/A	N/A
delta-BHC	3	0	0	N/A	N/A	N/A
gamma-BHC (Lindane)	3	0	0	N/A	N/A	N/A
gamma-Chlordane	3	0	0	N/A	N/A	N/A
				(ppb)	(ppb)	(ppb)
● Semi-Volatiles Organics						
Acenaphthene	3	0	0	N/A	N/A	N/A
Acenaphthylene	3	0	0	N/A	N/A	N/A
Anthracene	3	0	0	N/A	N/A	N/A
Benzo(a)anthracene	7	1	14	180.00	180.00	180.00
Benzo(a)pyrene	7	1	14	210.00	210.00	210.00
Benzo(b)fluoranthene	7	1	14	340.00	340.00	340.00
Benzo(g,h,i)perylene	3	0	0	N/A	N/A	N/A
Benzo(k)fluoranthene	3	0	0	N/A	N/A	N/A
Benzoic Acid	3	0	0	N/A	N/A	N/A
Chrysene	7	1	14	200.00	200.00	200.00
Di-n-butylphthalate	6	4	67	98.00	200.00	162.00
Di-n-octylphthalate	3	0	0	N/A	N/A	N/A
Dibenz(a,h)anthracene	3	0	0	N/A	N/A	N/A
Fluoranthene	7	1	14	170.00	170.00	170.00
Fluorene	7	0	0	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	3	0	0	N/A	N/A	N/A
Naphthalene	7	0	0	N/A	N/A	N/A
Pentachlorophenol	3	0	0	N/A	N/A	N/A
Phenanthrene	7	0	0	N/A	N/A	N/A
Pyrene	7	1	14	280.00	280.00	280.00
bis(2-ethylhexyl)phthalate	7	2	29	36.00	66.00	51.00

TABLE 4-13

CHEMICAL CONCENTRATIONS OF COMPOUNDS
OF CONCERN IN AREA 4

Analyte	No. of Samples	No. of Detects	Frequency (%) of Detects	Min.	Max.	Average
				(ppm)	(ppm)	(ppm)
● Metals						
Arsenic	14	14	100	1.62	12.80	5.23
Cadmium	14	9	64	0.24	1.70	0.56
Chromium	14	14	100	6.59	35.40	22.78
Copper	14	14	100	6.26	48.00	28.45
Lead	14	14	100	3.14	26.80	11.30
Mercury	14	13	93	0.03	0.35	0.15
Selenium	14	6	43	0.24	0.61	0.33
				(ppb)	(ppb)	(ppb)
● Volatile Organics						
2-Butanone	26	3	12	1.00	12.00	6.00
Acetone	11	6	55	12.00	300.00	143.70
Benzene	26	4	15	130.00	6,700.00	3,497.50
Chloroform	24	0	0	N/A	N/A	N/A
Ethylbenzene	26	7	27	4.00	14,000.00	4,760.60
Methylene Chloride	9	7	78	6.00	2,400.00	578.00
Toluene	26	10	38	2.00	11,000.00	1,391.30
Xylene (total)	26	4	15	2.00	42,000.00	11,001.00
				(ppb)	(ppb)	(ppb)
● Pesticides and PCB's						
4,4'-DDD	27	0	0	N/A	N/A	N/A
4,4'-DDE	27	0	0	N/A	N/A	N/A
4,4'-DDT	27	0	0	N/A	N/A	N/A
Aldrin	27	0	0	N/A	N/A	N/A
Aroclor-1016	27	0	0	N/A	N/A	N/A
Aroclor-1221	27	0	0	N/A	N/A	N/A
Aroclor-1232	27	0	0	N/A	N/A	N/A
Aroclor-1242	27	0	0	N/A	N/A	N/A
Aroclor-1248	27	0	0	N/A	N/A	N/A
Aroclor-1254	27	0	0	N/A	N/A	N/A
Aroclor-1260	27	0	0	N/A	N/A	N/A
Dieldrin	27	1	4	35.00	35.00	35.00
Heptachlor	27	1	4	87.00	87.00	87.00
Heptachlor epoxide	27	0	0	N/A	N/A	N/A
Toxaphene	27	0	0	N/A	N/A	N/A
alpha-BHC	27	0	0	N/A	N/A	N/A
alpha-Chlordane	27	0	0	N/A	N/A	N/A
beta-BHC	27	0	0	N/A	N/A	N/A
delta-BHC	27	0	0	N/A	N/A	N/A
gamma-BHC (Lindane)	27	0	0	N/A	N/A	N/A
gamma-Chlordane	27	0	0	N/A	N/A	N/A
				(ppb)	(ppb)	(ppb)
● Semi-Volatiles Organics						
Acenaphthene	27	3	11	140.00	2,300.00	1,546.70
Acenaphthylene	27	0	0	N/A	N/A	N/A
Anthracene	27	1	4	16,000.00	16,000.00	16,000.00
Benzo(a)anthracene	27	1	4	1,500.00	1,500.00	1,500.00
Benzo(a)pyrene	27	1	4	110.00	110.00	110.00
Benzo(b)fluoranthene	27	1	4	170.00	170.00	170.00
Benzo(g,h,i)perylene	27	1	4	77.00	77.00	77.00
Benzo(k)fluoranthene	27	1	4	91.00	91.00	91.00
Benzoic Acid	27	2	7	76.00	87.00	81.50
Chrysene	27	5	19	97.00	8,000.00	2,201.40
Di-n-butylphthalate	23	1	4	470.00	470.00	470.00
Di-n-octylphthalate	27	2	7	110.00	120.00	115.00
Dibenz(a,h)anthracene	27	0	0	N/A	N/A	N/A
Fluoranthene	27	1	4	68.00	68.00	68.00
Fluorene	27	5	19	1,100.00	18,000.00	7,840.00
Indeno(1,2,3-cd)pyrene	27	1	4	74.00	74.00	74.00
Naphthalene	27	5	19	660.00	24,000.00	13,032.00
Pentachlorophenol	27	0	0	N/A	N/A	N/A
Phenanthrene	27	4	15	430.00	29,000.00	10,632.50
Pyrene	27	4	15	47.00	1,500.00	425.30
bis(2-ethylhexyl)phthalate	18	3	17	65.00	190.00	107.00

TABLE 4-14
CHEMICAL CONCENTRATIONS OF COMPOUNDS
OF CONCERN IN AREA 5

Analyte	No. of Samples	No. of Detects	Frequency (%) of Detects	Min.	Max.	Average
				(ppm)	(ppm)	(ppm)
● Metals						
Arsenic	5	5	100	7.50	17.00	11.70
Cadmium	6	4	67	0.27	1.40	0.85
Chromium	6	6	100	6.70	43.20	30.57
Copper	6	6	100	22.50	103.00	62.93
Lead	6	6	100	1.70	19.50	9.30
Mercury	6	5	83	0.04	0.32	0.15
Selenium	5	4	80	0.26	4.80	1.47
● Volatile Organics						
				(ppb)	(ppb)	(ppb)
2-Butanone	10	2	20	12.00	15.00	13.50
Acetone	5	2	40	7.00	28.00	17.50
Benzene	10	0	0	N/A	N/A	N/A
Chloroform	10	1	10	5.00	5.00	5.00
Ethylbenzene	10	0	0	N/A	N/A	N/A
Methylene Chloride	2	0	0	N/A	N/A	N/A
Toluene	10	4	40	1.00	420.00	123.00
Xylene (total)	10	0	0	N/A	N/A	N/A
● Pesticides and PCB's						
				(ppb)	(ppb)	(ppb)
4,4'-DDD	10	0	0	N/A	N/A	N/A
4,4'-DDE	10	0	0	N/A	N/A	N/A
4,4'-DDT	10	1	10	22.00	22.00	22.00
Aldrin	10	0	0	N/A	N/A	N/A
Aroclor-1016	10	0	0	N/A	N/A	N/A
Aroclor-1221	10	0	0	N/A	N/A	N/A
Aroclor-1232	10	0	0	N/A	N/A	N/A
Aroclor-1242	10	0	0	N/A	N/A	N/A
Aroclor-1248	10	0	0	N/A	N/A	N/A
Aroclor-1254	10	0	0	N/A	N/A	N/A
Aroclor-1260	10	0	0	N/A	N/A	N/A
Dieldrin	10	0	0	N/A	N/A	N/A
Heptachlor	10	0	0	N/A	N/A	N/A
Heptachlor epoxide	10	0	0	N/A	N/A	N/A
Toxaphene	10	0	0	N/A	N/A	N/A
alpha-BHC	10	0	0	N/A	N/A	N/A
alpha-Chlordane	10	0	0	N/A	N/A	N/A
beta-BHC	10	0	0	N/A	N/A	N/A
delta-BHC	10	0	0	N/A	N/A	N/A
gamma-BHC (Lindane)	10	0	0	N/A	N/A	N/A
gamma-Chlordane	10	0	0	N/A	N/A	N/A
● Semi-Volatiles Organics						
				(ppb)	(ppb)	(ppb)
Acenaphthene	10	0	0	N/A	N/A	N/A
Acenaphthylene	10	0	0	N/A	N/A	N/A
Anthracene	10	0	0	N/A	N/A	N/A
Benzo(a)anthracene	10	0	0	N/A	N/A	N/A
Benzo(a)pyrene	10	0	0	N/A	N/A	N/A
Benzo(b)fluoranthene	10	0	0	N/A	N/A	N/A
Benzo(g,h,i)perylene	10	0	0	N/A	N/A	N/A
Benzo(k)fluoranthene	10	0	0	N/A	N/A	N/A
Benzoic Acid	10	0	0	N/A	N/A	N/A
Chrysene	10	0	0	N/A	N/A	N/A
Di-n-butylphthalate	23	3	30	90.00	860.00	513.30
Di-n-octylphthalate	10	0	0	N/A	N/A	N/A
Dibenz(a,h)anthracene	10	0	0	N/A	N/A	N/A
Fluoranthene	10	0	0	N/A	N/A	N/A
Fluorene	10	0	0	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	10	0	0	N/A	N/A	N/A
Naphthalene	10	0	0	N/A	N/A	N/A
Pentachlorophenol	10	0	0	N/A	N/A	N/A
Phenanthrene	10	0	0	N/A	N/A	N/A
Pyrene	10	1	10	87.00	87.00	87.00
bis(2-ethylhexyl)phthalate	10	2	20	140.00	150.000	145.00

TABLE 4-15
CHEMICAL CONCENTRATIONS OF COMPOUNDS
OF CONCERN IN AREA 6

Analyte	No. of Samples	No. of Detects	Frequency (%) of Detects	Min.	Max.	Average
				(ppm)	(ppm)	(ppm)
● Metals						
Arsenic	5	5	100	3.50	9.55	6.05
Cadmium	6	6	100	0.30	2.30	1.40
Chromium	6	5	83	7.40	30.00	17.48
Copper	6	6	100	6.00	39.20	17.06
Lead	6	6	100	1.50	13.50	6.27
Mercury	6	3	50	0.03	0.11	0.08
Selenium	6	2	33	0.25	0.26	0.26
				(ppb)	(ppb)	(ppb)
● Volatile Organics						
2-Butanone	17	2	12	20.00	92.00	56.00
Acetone	5	5	100	29.00	73.00	42.40
Benzene	17	2	12	1.00	6.00	3.50
Chloroform	14	0	0	N/A	N/A	N/A
Ethylbenzene	17	3	18	5.00	11.00	8.70
Methylene Chloride	4	4	100	6.00	8.00	7.25
Toluene	17	4	24	2.00	24.00	13.50
Xylene (total)	17	3	18	16.00	31.00	24.30
				(ppb)	(ppb)	(ppb)
● Pesticides and PCB's						
4,4'-DDD	17	0	0	N/A	N/A	N/A
4,4'-DDE	17	0	0	N/A	N/A	N/A
4,4'-DDT	17	0	0	N/A	N/A	N/A
Aldrin	17	0	0	N/A	N/A	N/A
Aroclor-1016	17	0	0	N/A	N/A	N/A
Aroclor-1221	17	0	0	N/A	N/A	N/A
Aroclor-1232	17	0	0	N/A	N/A	N/A
Aroclor-1242	17	0	0	N/A	N/A	N/A
Aroclor-1248	17	1	6	1,700.00	1,700.000	1,700.00
Aroclor-1254	17	0	0	N/A	N/A	N/A
Aroclor-1260	17	0	0	N/A	N/A	N/A
Dieldrin	17	0	0	N/A	N/A	N/A
Heptachlor	17	0	0	N/A	N/A	N/A
Heptachlor epoxide	17	0	0	N/A	N/A	N/A
Toxaphene	17	0	0	N/A	N/A	N/A
alpha-BHC	17	0	0	N/A	N/A	N/A
alpha-Chlordane	17	0	0	N/A	N/A	N/A
beta-BHC	17	0	0	N/A	N/A	N/A
delta-BHC	17	0	0	N/A	N/A	N/A
gamma-BHC (Lindane)	17	0	0	N/A	N/A	N/A
gamma-Chlordane	17	0	0	N/A	N/A	N/A
				(ppb)	(ppb)	(ppb)
● Semi-Volatiles Organics						
Acenaphthene	17	0	0	N/A	N/A	N/A
Acenaphthylene	17	1	6	71.00	71.00	71.00
Anthracene	17	0	0	N/A	N/A	N/A
Benzo(a)anthracene	17	0	0	N/A	N/A	N/A
Benzo(a)pyrene	17	0	0	N/A	N/A	N/A
Benzo(b)fluoranthene	17	1	0	N/A	N/A	N/A
Benzo(g,h,i)perylene	17	0	0	N/A	N/A	N/A
Benzo(k)fluoranthene	17	0	0	N/A	N/A	N/A
Benzoic Acid	17	2	12	69.00	220.00	144.50
Chrysene	17	0	0	N/A	N/A	N/A
Di-n-butylphthalate	17	1	6	1,800.00	1,800.00	1,800.00
Di-n-octylphthalate	17	1	6	88,000.00	88,000.00	88,000.00
Dibenz(a,h)anthracene	17	0	0	N/A	N/A	N/A
Fluoranthene	17	1	6	150.00	150.00	150.00
Fluorene	17	0	0	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	17	0	0	N/A	N/A	N/A
Naphthalene	17	0	0	N/A	N/A	N/A
Pentachlorophenol	17	0	0	N/A	N/A	N/A
Phenanthrene	17	0	0	N/A	N/A	N/A
Pyrene	17	1	6	220.00	220.00	220.00
bis(2-ethylhexyl)phthalate	14	4	29	38.00	830,000.00	209,584.00

TABLE 4-16

CHEMICAL CONCENTRATIONS OF COMPOUNDS
OF CONCERN IN AREA 7

Analyte	No. of Samples	No. of Detects	Frequency (%) of Detects	Min.	Max.	Average
				(ppm)	(ppm)	(ppm)
● Metals						
Arsenic	3	3	100	3.00	12.10	6.50
Cadmium	4	3	75	1.64	5.70	3.21
Chromium	4	4	100	20.20	55.80	35.58
Copper	4	4	100	19.80	79.70	49.30
Lead	4	4	100	10.00	63.00	29.25
Mercury	4	1	25	0.02	0.02	0.02
Selenium	2	1	50	0.25	0.25	0.25
				(ppb)	(ppb)	(ppb)
● Volatile Organics						
2-Butanone	5	0	0	N/A	N/A	N/A
Acetone	2	1	50	16.00	16.00	16.00
Benzene	4	0	0	N/A	N/A	N/A
Chloroform	4	0	0	N/A	N/A	N/A
Ethylbenzene	4	1	25	3.00	3.00	3.00
Methylene Chloride	3	2	67	4.00	810.00	407.00
Toluene	3	0	0	N/A	N/A	N/A
Xylene (total)	3	0	0	N/A	N/A	N/A
				(ppb)	(ppb)	(ppb)
● Pesticides and PCB's						
4,4'-DDD	6	0	0	N/A	N/A	N/A
4,4'-DDE	6	0	0	N/A	N/A	N/A
4,4'-DDT	6	0	0	N/A	N/A	N/A
Aldrin	6	0	0	N/A	N/A	N/A
Aroclor-1016	6	0	0	N/A	N/A	N/A
Aroclor-1221	6	0	0	N/A	N/A	N/A
Aroclor-1232	6	0	0	N/A	N/A	N/A
Aroclor-1242	6	0	0	N/A	N/A	N/A
Aroclor-1248	6	0	0	N/A	N/A	N/A
Aroclor-1254	6	0	0	N/A	N/A	N/A
Aroclor-1260	6	0	0	N/A	N/A	N/A
Dieldrin	6	0	0	N/A	N/A	N/A
Heptachlor	6	0	0	N/A	N/A	N/A
Heptachlor epoxide	6	0	0	N/A	N/A	N/A
Toxaphene	6	0	0	N/A	N/A	N/A
alpha-BHC	6	0	0	N/A	N/A	N/A
alpha-Chlordane	6	0	0	N/A	N/A	N/A
beta-BHC	6	0	0	N/A	N/A	N/A
delta-BHC	6	0	0	N/A	N/A	N/A
gamma-BHC (Lindane)	6	0	0	N/A	N/A	N/A
gamma-Chlordane	6	0	0	N/A	N/A	N/A
				(ppb)	(ppb)	(ppb)
● Semi-Volatiles Organics						
Acenaphthene	6	0	0	N/A	N/A	N/A
Acenaphthylene	6	0	0	N/A	N/A	N/A
Anthracene	6	0	0	N/A	N/A	N/A
Benzo(a)anthracene	6	0	0	N/A	N/A	N/A
Benzo(a)pyrene	6	1	17	960.00	960.00	960.00
Benzo(b)fluoranthene	6	0	0	N/A	N/A	N/A
Benzo(g,h,i)perylene	6	0	0	N/A	N/A	N/A
Benzo(k)fluoranthene	6	0	0	N/A	N/A	N/A
Benzoic Acid	5	0	0	N/A	N/A	N/A
Chrysene	6	1	17	300.00	300.00	300.00
Di-n-butylphthalate	4	0	0	N/A	N/A	N/A
Di-n-octylphthalate	6	0	0	N/A	N/A	N/A
Dibenz(a,h)anthracene	6	0	0	N/A	N/A	N/A
Fluoranthene	6	0	0	N/A	N/A	N/A
Fluorene	6	0	0	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	6	0	0	N/A	N/A	N/A
Naphthalene	6	0	0	N/A	N/A	N/A
Pentachlorophenol	6	0	0	N/A	N/A	N/A
Phenanthrene	6	0	0	N/A	N/A	N/A
Pyrene	6	1	17	36.00	36.00	36.00
bis(2-ethylhexyl)phthalate	4	1	25	25.00	350.00	350.00

TABLE 4-17

CHEMICAL CONCENTRATIONS OF COMPOUNDS
OF CONCERN IN AREA 8

Analyte	No. of Samples	No. of Detects	Frequency (%) of Detects	Min.	Max.	Average
● Metals				(ppm)	(ppm)	(ppm)
Arsenic	52	52	100	1.00	18.00	6.04
Cadmium	52	20	38	0.33	1.87	0.98
Chromium	52	52	100	5.70	62.70	21.87
Copper	52	51	98	4.80	270.00	28.09
Lead	52	52	100	1.50	2,640.00	71.38
Mercury	52	30	58	0.02	0.62	0.16
Selenium	51	17	33	0.20	1.20	0.58
● Volatile Organics				(ppb)	(ppb)	(ppb)
2-Butanone	22	3	14	11.00	78.00	34.30
Acetone	20	3	15	8.00	63.00	29.00
Benzene	44	0	0	N/A	N/A	N/A
Chloroform	38	0	0	N/A	N/A	N/A
Ethylbenzene	45	8	18	10.00	11,000.00	3,122.90
Methylene Chloride	24	7	29	1.00	14.00	266.90
Toluene	42	30	71	6.00	12,000.00	735.40
Xylene (total)	44	6	14	360.00	2,800.00	1,865.00
● Pesticides and PCB's				(ppb)	(ppb)	(ppb)
4,4'-DDD	41	6	15	130.00	62,000.00	11,921.70
4,4'-DDE	41	5	12	66.00	30,000.00	6,261.20
4,4'-DDT	33	3	9	6.00	260,000.00	87,113.30
Aldrin	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1016	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1221	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1232	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1242	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1248	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1254	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1260	0	N/A	N/A	N/A	N/A	N/A
Dieldrin	0	N/A	N/A	N/A	N/A	N/A
Heptachlor	0	N/A	N/A	N/A	N/A	N/A
Heptachlor epoxide	0	N/A	N/A	N/A	N/A	N/A
Toxaphene	0	N/A	N/A	N/A	N/A	N/A
alpha-BHC	0	N/A	N/A	N/A	N/A	N/A
alpha-Chlordane	0	N/A	N/A	N/A	N/A	N/A
beta-BHC	0	N/A	N/A	N/A	N/A	N/A
delta-BHC	36	2	6	230.00	980.00	605.00
gamma-BHC (Lindane)	0	N/A	N/A	N/A	N/A	N/A
gamma-Chlordane	36	5	14	36.00	12.00	483.20
● Semi-Volatiles Organics				(ppb)	(ppb)	(ppb)
Acenaphthene	33	0	0	N/A	N/A	N/A
Acenaphthylene	40	0	0	N/A	N/A	N/A
Anthracene	38	1	3	620.00	620.00	620.00
Benzo(a)anthracene	38	0	0	N/A	N/A	N/A
Benzo(a)pyrene	38	1	3	96.00	96.00	96.00
Benzo(b)fluoranthene	38	1	3	130.00	130.00	130.00
Benzo(g,h,i)perylene	36	1	3	91.00	91.00	91.00
Benzo(k)fluoranthene	33	0	0	N/A	N/A	N/A
Benzoic Acid	38	0	0	N/A	N/A	N/A
Chrysene	38	4	11	99.00	280.00	167.30
Di-n-butylphthalate	30	3	10	52.00	190.00	120.70
Di-n-octylphthalate	33	2	6	230.00	240.00	235.00
Dibenz(a,h)anthracene	31	0	0	N/A	N/A	N/A
Fluoranthene	39	0	0	N/A	N/A	N/A
Fluorene	34	5	15	92.00	2,000.00	590.40
Indeno(1,2,3-cd)pyrene	36	1	3	89.00	89.00	89.00
Naphthalene	46	6	13	78.00	1,900.00	804.70
Pentachlorophenol	33	0	0	N/A	N/A	N/A
Phenanthrene	39	6	15	76.00	4,500.00	1,191.00
Pyrene	38	1	3	770.00	770.00	770.00
bis(2-ethylhexyl)phthalate	23	4	17	84.00	490.00	251.00

TABLE 4-18

CHEMICAL CONCENTRATIONS OF COMPOUNDS
OF CONCERN IN SCHOOL/FEDCO

Analyte	No. of Samples	No. of Detects	Frequency (%) of Detects	Min.	Max.	Average
● Metals				(ppm)	(ppm)	(ppm)
Arsenic	12	12	100	1.63	15.90	5.56
Cadmium	12	3	25	0.26	0.36	0.29
Chromium	12	12	100	5.90	51.20	17.85
Copper	12	12	100	4.95	41.50	20.27
Lead	12	12	100	1.70	10.00	5.92
Mercury	12	6	50	0.02	0.19	0.12
Selenium	12	3	25	0.20	0.28	0.24
● Volatile Organics				(ppb)	(ppb)	(ppb)
2-Butanone	0	N/A	N/A	N/A	N/A	N/A
Acetone	6	3	50	11.00	32.00	24.30
Benzene	0	N/A	N/A	N/A	N/A	N/A
Chloroform	6	2	33	1.00	2.00	1.50
Ethylbenzene	0	N/A	N/A	N/A	N/A	N/A
Methylene Chloride	0	N/A	N/A	N/A	N/A	N/A
Toluene	0	N/A	N/A	N/A	N/A	N/A
Xylene (total)	0	N/A	N/A	N/A	N/A	N/A
● Pesticides and PCB's						
4,4'-DDD	0	N/A	N/A	N/A	N/A	N/A
4,4'-DDE	0	N/A	N/A	N/A	N/A	N/A
4,4'-DDT	0	N/A	N/A	N/A	N/A	N/A
Aldrin	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1016	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1221	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1232	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1242	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1248	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1254	0	N/A	N/A	N/A	N/A	N/A
Aroclor-1260	0	N/A	N/A	N/A	N/A	N/A
Dieldrin	0	N/A	N/A	N/A	N/A	N/A
Heptachlor	0	N/A	N/A	N/A	N/A	N/A
Heptachlor epoxide	0	N/A	N/A	N/A	N/A	N/A
Toxaphene	0	N/A	N/A	N/A	N/A	N/A
alpha-BHC	0	N/A	N/A	N/A	N/A	N/A
alpha-Chlordane	0	N/A	N/A	N/A	N/A	N/A
beta-BHC	0	N/A	N/A	N/A	N/A	N/A
delta-BHC	0	N/A	N/A	N/A	N/A	N/A
gamma-BHC (Lindane)	0	N/A	N/A	N/A	N/A	N/A
gamma-Chlordane	0	N/A	N/A	N/A	N/A	N/A
● Semi-Volatiles Organics						
Acenaphthene	0	N/A	N/A	N/A	N/A	N/A
Acenaphthylene	0	N/A	N/A	N/A	N/A	N/A
Anthracene	0	N/A	N/A	N/A	N/A	N/A
Benzo(a)anthracene	0	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0	N/A	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	0	N/A	N/A	N/A	N/A	N/A
Benzo(g,h,i)perylene	0	N/A	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0	N/A	N/A	N/A	N/A	N/A
Benzoic Acid	0	N/A	N/A	N/A	N/A	N/A
Chrysene	0	N/A	N/A	N/A	N/A	N/A
Di-n-butylphthalate	0	N/A	N/A	N/A	N/A	N/A
Di-n-octylphthalate	0	N/A	N/A	N/A	N/A	N/A
Dibenz(a,h)anthracene	0	N/A	N/A	N/A	N/A	N/A
Fluoranthene	0	N/A	N/A	N/A	N/A	N/A
Fluorene	0	N/A	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	0	N/A	N/A	N/A	N/A	N/A
Naphthalene	0	N/A	N/A	N/A	N/A	N/A
Pentachlorophenol	0	N/A	N/A	N/A	N/A	N/A
Phenanthrene	0	N/A	N/A	N/A	N/A	N/A
Pyrene	0	N/A	N/A	N/A	N/A	N/A
bis(2-ethylhexyl)phthalate	0	N/A	N/A	N/A	N/A	N/A

TABLE 6-4

ORGANIC GASES DETECTED AT THE WDI RESERVOIR/WASTE-HANDLING AREAS

Compound	Reservoir	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8
1,1,1-Trichloroethane		X	X				X	X	X
1,2-Dichloroethene									X
Benzene	X		X				X		X
Chloroform									X
Methane	X	X	X			X		X	X
Tetrachloroethene	X	x	X		X	X	X	X	X
Trichloroethene	X	x	X		X	X	X	X	X
Vinyl Chloride	X		X						X

3747E

TABLE 4-10
SOIL EXPOSURE POINT CONCENTRATIONS USED TO DETERMINE
RISKS ASSOCIATED WITH THE FUTURE USE DIRECT CONTACT PATHWAYS
WDI SITE

Chemical	CONCENTRATION	
	Average	Maximum
CARCINOGENS		
INORGANICS	(mg/kg)	(mg/kg)
Arsenic	6.5	337
ORGANICS	(ug/kg)	(ug/kg)
Aldrin	23	23
Benzene	110	19,000
BHC (delta & gamma isomers)*	485	995
Carbon Tetrachloride	2	2
Chlordane (alpha & gamma isomers)	79	2,060
Chloroform	1.6	5
DDT/DDE/DDO	206	352,000
Dieldrin	63	280
1,4-Dichlorobenzene	170	2,400
Heptachlor	87	87
Heptachlor Epoxide	9.6	46
Methylene Chloride	18	1,200
PAHs - Carcinogenic	1,340	13,460
PCBs	1,130	5,550
Pentachlorophenol	240	320
Tetrachloroethylene	28	43,000
Trichloroethylene	140	5,000
Vinyl Chloride	31	1,700

SSLs (migration
to groundwater)

.30

10

TABLE 4-10 (cont'd)
SOIL EXPOSURE POINT CONCENTRATIONS USED TO DETERMINE
RISKS ASSOCIATED WITH THE FUTURE USE DIRECT CONTACT PATHWAYS
W01 SITE

Chemical	CONCENTRATION	
	Average	Maximum
NONCARCINOGENS		
INORGANICS	(mg/kg)	(mg/kg)
Antimony	5.2	25
Arsenic	6.5	337
Cadmium	1.0	18
Chromium	26	149
Copper	30	721
Lead	20	2,790
Manganese	400	2,270
Mercury	0.13	11
Selenium	0.41	1
Thallium	14	39
Zinc	83	490,490
ORGANICS	(ug/kg)	(ug/kg)
Aldrin	23	23
gamma-BHC *	15	15
Benzoic Acid	170	1,300
2-Butanone	16	11,000
Carbon Tetrachloride	2	2
Chlordane	79	2,060
Chloroform	1.6	5
DDT/DDE/DDD	206	352,000
1,4-Dichlorobenzene	170	2,400
Dieldrin	63	280
Ethylbenzene	160	30,000
Heptachlor	87	87
Heptachlor Epoxide	9.6	46
Methylene Chloride	18	1,200
PAHs- Noncarcinogenic	3,169	302,930
Pentachlorophenol	240	320
Tetrachloroethylene	28	43,000
Toluene	77	120,000
1,1,1-Trichloroethane	500	1,800
Trichloroethylene	140	5,000
Xylenes	380	250,000

* Only the gamma isomer of BHC has a noncarcinogenic toxicity value.

EPA WORK ASSIGNMENT NO. 208-9LC1
UNDER
EPA CONTRACT NO. 68-01-7250

FINAL ENDANGERMENT ASSESSMENT

WASTE DISPOSAL, INC.
SANTA FE SPRINGS, CALIFORNIA

NOVEMBER 1989

TABLE 4-10 (cont'd)
SOIL EXPOSURE POINT CONCENTRATIONS USED TO DETERMINE
RISKS ASSOCIATED WITH THE FUTURE USE DIRECT CONTACT PATHWAYS
WDI SITE

Chemical	CONCENTRATION	
	Average	Maximum
NONCARCINOGENS		
INORGANICS	(mg/kg)	(mg/kg)
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DDT/DDE/DDD	206	352,000
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Methylene Chloride	18	1,200
PAHs- Noncarcinogenic	3,169	302,930
Pentachlorophenol	240	320
Tetrachloroethylene	28	43,000
Toluene	77	120,000
1,1,1-Trichloroethane	500	1,800
Trichloroethylene	140	5,000
Xylenes	380	250,000

* Only the gamma isomer of BHC has a noncarcinogenic toxicity value.

TABLE 4-10
SOIL EXPOSURE POINT CONCENTRATIONS USED TO DETERMINE
RISKS ASSOCIATED WITH THE FUTURE USE DIRECT CONTACT PATHWAYS
WDI SITE

Chemical	CONCENTRATION	
	Average	Maximum
CARCINOGENS		
INORGANICS	(mg/kg)	(mg/kg)
Arsenic	6.5	337
ORGANICS	(ug/kg)	(ug/kg)
Aldrin	23	23
Benzene	110	19,000
BHC (delta & gamma isomers)*	485	995
Carbon Tetrachloride	2	2
Chlordane (alpha & gamma isomers)	79	2,060
Chloroform	1.6	5
DDT/DDE/DDD	206	352,000
Dieldrin	63	280
1,4-Dichlorobenzene	170	2,400
Heptachlor	87	87
Heptachlor Epoxide	9.6	46
Methylene Chloride	18	1,200
PAHs - Carcinogenic	1,340	13,460
PCBs	1,130	5,550
Pentachlorophenol	240	320
Tetrachloroethylene	28	43,000
Trichloroethylene	140	5,000
Vinyl Chloride	31	1,700

TABLE 4-11.
EXPOSURE POINT CONCENTRATIONS OF CHEMICALS
OF POTENTIAL CONCERN IN GROUNDWATER

WDI SITE

A. POTENTIALLY CARCINOGENIC CHEMICALS

Chemical	Concentration (ug/liter)	
	Geometric Mean	Maximum
INORGANICS		
Arsenic	5.9	12
ORGANICS		
Chloroform	2.8	9
Tetrachloroethylene	2.6	11
Trichloroethylene	2.7	18

B. NONCARCINOGENIC CHEMICALS

Chemical	Concentration (ug/liter)	
	Geometric Mean	Maximum
INORGANICS		
Arsenic	5.9	12
Lead	4.0	16
Manganese	495	5850
Mercury	0.15	2.0
ORGANICS		
Chloroform	2.8	9
Tetrachloroethylene	2.6	11
Toluene	2.6	5.0
Trichloroethylene	2.7	18

TABLE 2-6
SUBSURFACE GAS SAMPLE RESULTS
COLLECTED AT THE WDI SITE

Chemical	CONCENTRATION (in ug/m3)						
	Detection Frequency	Total Samples	Geometric Mean (a)	Geometric Mean (b)	Maximum	Detection Limit	Blank Geometric Mean (c)
Benzene	38%	26	99	524	28,000	64	67
Carbon Tetrachloride	3.8%	26	1.7	9.4	9.4	3.1	ND (d)
Chloroform	15%	26	3.8	45	120	4.9	ND
1,2-Dibromoethane	81%	26	160	209	590	110	210
1,2-Dichloroethane	3.8%	26	42	117	120	81	ND
Tetrachloroethylene	100%	26	88	88	520	6.8	30
1,1,1-Trichloroethane	50%	26	44	130	6,300	27	39
Trichloroethylene	92%	26	150	215	16,000	5.4	9.1
Vinyl Chloride	12%	26	38	945	20,000	51	ND

- (a) - Geometric mean using all positively detected samples and one half the detection limit for non-detected samples.
 (b) - Geometric mean using positive detects only.
 (c) - Two blank samples were collected.
 (d) - ND = Not detected in either blank sample.

**SUPERFUND
1992 GROUNDWATER MONITORING REPORT
WASTE DISPOSAL, INCORPORATED
SANTA FE SPRINGS, CALIFORNIA**

**Prepared by: Katherine J. Baylor
Laboratory Support Section
Environmental Services Branch
U.S. Environmental Protection Agency**

January 1993

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INTRODUCTION

Groundwater samples were collected from 11 wells during three sampling events in 1992 (February, May, and August) at the Waste Disposal, Incorporated (WDI) Superfund site in Santa Fe Springs, California.

1.0 OBJECTIVE

Prior to this investigation, groundwater at the WDI site had been sampled twice to characterize contamination at the site; the most recent sampling prior to this investigation was conducted by EBASCO in January 1989. The previous investigations found low-level contamination in the shallow aquifer under the WDI site. The locations of the existing wells do not adequately characterize the groundwater quality of the deeper aquifer; however, previous investigations indicate that it has not been impacted, and was not included in this scope of work.

The objective of this sampling effort was as follows:

To confirm previous analytical results and increase the data base for organic and inorganic parameters in the shallow aquifer at the site.

2.0 BACKGROUND

2.1 SITE DESCRIPTION

The following site history is taken from the WDI Site Final Remedial Investigation Report (EBASCO Services Incorporated, 1989).

The Waste Disposal, Inc. (WDI) site consists of a 43-acre parcel located in the city of Santa Fe Springs, Los Angeles County, California (Figure 2.1). The site is bordered on the northwest by Santa Fe Springs Road, on the northeast by a Fedco food distribution center and St. Paul's High School, on the southwest by Los Nietos Road, and on the southeast by Greenleaf Avenue (Figure 2.2).

The WDI site was operated as a landfill, which, over a period of 40 years, accepted various oil-field and industrial wastes. The wastes were contained in a 1,000,000-barrel capacity concrete-lined reservoir and several unlined waste handling areas. Prior to 1949, operations at the facility were unregulated; between 1949 and 1965-66, Waste Disposal, Inc. operated as a permitted landfill. A profile of the site contamination indicates the presence of hydrocarbons, oil-field wastes containing metals, and volatile organics in the subsurface materials.

2.2 SITE HISTORY

Waste disposal operations at the WDI site from 1949 until closure were sporadically documented. Many documents allegedly pertaining to the materials disposed have been destroyed (Herrera 1986). Thus, a comprehensive site disposal history is not available. However, the Potentially Responsible Party Search conducted by ICF Technology (1987) and a records search and review of aerial photographs, as described below, have provided some information regarding past waste disposal activities at WDI.

The Santa Fe Springs Oil Field was discovered by Union Oil Company of California in 1919. Sometime thereafter (probably between 1919 and 1928), a 1,000,000 barrel (42 million gallon) capacity concrete lined reservoir was constructed at the WDI site. The reservoir was apparently used for petroleum storage. In the late 1920s, the WDI reservoir was decommissioned. Aerial photographs (WCCA 1928, 1937, 1945) indicate that a similarly sized reservoir was located across Santa Fe Springs Road, approximately 800 feet to the northwest, on land owned by Union Oil Company.

A review of aerial photographs (EMSL 1988) shows evidence of waste disposal at the site between the late 1920s and 1949. A 1937 photograph indicates that standing liquid was present outside of the reservoir to the northwest, southeast, and south of the reservoir inside dikes, and to the northwest and southwest of the reservoir outside dikes. Disturbed ground as well as areas of fill were present along Greenleaf Avenue and Los Nietos Road. A 1958 photograph shows standing liquid in the reservoir, as well as inside the diked area to the north of the reservoir, and outside the dike to the northwest (Figure 2.3).

In 1949, Fernando Caneer was granted a permit to operate a dump in the reservoir for the disposal of "solid fill, rotary mud, and other non-acid oil-well waste". In 1950, the County of Los Angeles issued to Whittier Area Disposal Co. (also known as Waste Disposal, Inc.) a permit for operation of the dump, allowing acceptance of rotary drilling mud, clean earth, rock, sand and gravel, paving fragments, concrete, brick, plaster, steel mill slag, and dry mud cake from oil field sumps. At the time, the one-million barrel capacity reservoir, located in the center of the site, was surrounded on three sides by an earth dike, which was itself surrounded by a channel. Many unlined ponds and waste handling areas also existed at the site.

Over the course of the next few years, further permits were issued to allow dumping of acetylene sludge (approximately 220 barrels/week) and 24 hour per day waste disposal. In 1955, a permit was issued to annex an area 600 feet north of Los Nietos Road, and west of the reservoir for the disposal of drilling mud. At least twice during facility operation, the reservoir and dike

system was inadequate to contain disposal liquids, sludges, and mud. In 1956, liquid wastes flowed into and were pumped through "gopher holes" in the dike into a surrounding channel and toward Greenleaf Avenue at a rate of about 5 gallons per minute. In 1962, after heavy rain, liquid containing oily substances seeped through the northerly dike onto the nearby St. Paul's Catholic High School grounds, traveling as far as the baseball diamond.

Between 1955 and 1960, numerous illegal discharges occurred in and around the site in the unlined waste handling areas. Liquids from Union Pacific Railroad and truck washings were disposed of directly on the ground, and facilities adjacent to WDI's eastern edge, along Greenleaf Avenue, also discharged waste liquids onto the WDI site.

As early as 1953, the Los Angeles County sewer system received liquids from WDI; early on, liquids were discharged to a channel leading to Greenleaf Avenue. Later (1960), a pipe from WDI was connected to the Los Angeles County sewer system with approval from the County of Los Angeles Department of Sanitation.

Beginning in 1958, solid fill was accepted and used to grade over the site. By September 1961, the reservoir was 50% full; by June 1962, it was 75% full. By November 1962, the reservoir was completely full of solid material; liquids flowed into diked areas. By October 1964, the site was closed to the public; final grading of the site continued until the end of 1966. Since that time, several businesses have moved onto the site.

2.3 PREVIOUS INVESTIGATIONS

The WDI site currently consists of many individually owned parcels of land (Figure 2.4). Several of these parcels and the central portion of the site, which contains the reservoir and several sumps, have been the focus of previous site investigations.

Prior to the Remedial Investigation, Dames and Moore conducted a series of studies at the WDI site to assess the nature and extent of subsurface contamination. These studies focused on the characterization of the soils and subsurface gas in the Toxo Spray Dust area, Campbell Property and the general reservoir area (Figure 3A). The study conducted in the reservoir area also included groundwater sampling and analysis at three monitoring wells installed around the perimeter of the WDI reservoir. The results of these investigations are summarized in the following sections.

Toxo Spray Dust - Toxo Spray Dust (Toxo) first owned and operated a pesticide manufacturing and storage facility adjacent to the WDI reservoir in 1953. In 1986, Dames and Moore personnel collected two samples from the flooring in the former dry-mix area of the Toxo production building and installed six shallow vapor probes. In late 1986, the Toxo operations building was demolished, and Dames and Moore collected two soil samples 10 inches below the former building location. Floor samples contained methylparathion, ethylparathion, endosulfan I, and endosulfan II. One of the soil-gas samples contained 231,000 ppm (23% by volume in air) of methane and 597 ppm of total nonmethane hydrocarbon as hexane. The soil samples contained malathion, ethylparathion, endosulfan I, aldrin, 4,4'-DDE and 4,4'-DDT. California Department of Health Service required the building to be demolished, which it was in 1986, with approximated 16 cubic yards of soil excavated and removed to a Class I landfill in Kettleman Hills, California.

Campbell Property - The Campbell property, located at the corner of Greenleaf and Los Nietos, was sampled on two occasions in 1986. A total of seven shallow (5 ft) organic vapor probes were installed. The results of soil-gas analyses indicated methane concentrations of 9,500 ppm and 11,200 ppm in two of the samples and a non-methane hydrocarbon concentration of 29 ppm in only one sample. Additionally, the Dames and Moore study included 21 cone penetrometer soundings (CPT) to estimate the volume of waste and overburden. The CPT soundings indicated the presence of very soft sump materials possibly including desiccated muds and loose fill. The total volume of waste and overburden was estimated to be about 10,000 to 16,000 cubic yards.

Dames and Moore also drilled six soil borings on the Campbell property, four in areas where drilling muds were previously encountered in the shallow subsurface. Five soil samples with high OVA readings were retained for analysis, and found to contain moderate levels of naphthalene, di-n-butyl phthalate, fluorene, phenanthrene, ethylbenzene, 2-methyl naphthalene, isophorene, chrysene, and low levels of metals.

Reservoir Area - In 1984, Dames and Moore drilled four borings at the WDI site; one in the center of the concrete reservoir, and three around the perimeter of the reservoir to a depth of 18-22 feet. Samples were collected every 2.5 feet, and screened with an HNu photoionization detector to determine which should undergo laboratory analysis. In 1985, Dames and Moore collected 35 shallow soil samples from the WDI site, the St. Paul High School athletic field, and a vacant lot approximately 1,050 to 1,300 feet NW of the WDI site.

The results of these investigations indicated various levels of barium, cadmium, copper, lead, mercury, nickel, silver, vanadium, and zinc. Two of the borings also contained ethylbenzene,

tetrachloroethene, toluene, trichloroethene, total xylenes, naphthalene, and phenanthrene.

Also in 1985, Dames and Moore installed one upgradient (MW-1) and two downgradient (MW-2,3) monitoring wells. Black (oily) solid waste was encountered during the drilling of MW-1 and MW-2 at approximately five feet depth. The wells were completed, and samples sent for analysis of priority pollutant organics and CAM metals. Because MW-3 was located near a pesticide storage area, the water sample was analyzed for organochloride pesticides and PCBs.

None of the Dames and Moore water samples contained detectable concentrations of either EPA priority pollutants or CAM metals. MW-3 contained 12 ppb of chlordane.

The Remedial Investigation was completed by EBASCO Services, Incorporated, in November 1989. The scope of the RI included soils, groundwater, and subsurface gas investigations, and the results are summarized below.

SOILS - Subsurface soil is the most prevalent contaminated medium at the WDI site. Chemical contamination is widespread. The WDI reservoir and waste handling areas are the major areas of contamination. The reservoir is covered by 5 to 15 feet of "relatively clean" artificial fill, underlain by black mud and sludge. The WDI waste handling areas are from 100 to 900 feet in width and 15 to 30 feet in depth. In general, soil contamination at the WDI site consists of the following:

- o Pesticides/PCBs are present at shallow depths .
- o Volatile organic compounds, predominantly benzene, toluene, and xylene are present at all depths.
- o Semivolatile compounds are present at all depths.
- o Metals compounds are present at all depths.

GROUNDWATER - The results of chemical analyses of groundwater samples from WDI indicate that metals are the most widespread of contaminants. Metals were detected both upgradient and downgradient of the WDI reservoir. Highest concentrations of metals were found in the upgradient wells. Findings of the groundwater characterization study, as well as monitoring well design specifications, are shown in Appendix A. They include:

- o Monitoring well GW-26 was the only well that showed contamination by trichloroethene above the MCL standards. None of the other monitoring wells showed any contamination by volatile organics.

- o Bis(2-chloroethyl)ether was the only semivolatile organic compound that was detected at more than one well, but it was not found consistently throughout the site.
- o Pesticides/PCBs were not detected in any of the monitoring wells.
- o Aluminum, iron, manganese, and selenium were found in concentrations exceeding the MCL standards in almost all wells. Both upgradient and downgradient wells showed high concentrations of these metals.

SUBSURFACE GAS - In general, the subsurface gases are distributed in and around the reservoir and waste handling areas. The reservoir and immediate surrounding area has subsurface vinyl chloride, benzene, and lower concentrations of chlorinated hydrocarbons as trace constituents in the gas. Methane was also identified in and around the reservoir, but not commonly elsewhere.

2.4 GEOLOGY AND HYDROGEOLOGY

Regional geology - The WDI site is located northwest of the Santa Ana Mountains, a dominant part of the northern Peninsular Ranges of coastal southern California which forms the eastern margin of the Los Angeles basin (Figure 2.5). Situated in the central block of the Los Angeles Basin, the WDI site is bounded on the northeast by the La Habra syncline and on the southwest by the Coyote Hills (Santa Fe Springs) anticline in an area commonly referred to as the Santa Fe Springs Plain. This plain is a gently rolling topographic feature which has probably been warped by the Santa Fe Springs-Coyote Hills anticlinal system and dips gently both to the northeast toward Whittier and to the southeast toward the Downey Plain. The difference in elevation ranges from 100 to 175 feet above mean sea level.

The surface of the Santa Fe Springs Plain and Coyote Hills reflects the structural high which trends northwest from the Coyote Hills in Orange County and is primarily developed in the underlying formations of Miocene and Pliocene age. In these sediments, the uplift consists of anticlinal folds which contain the Santa Fe Springs, Leffingwell, and West Coyote oil fields. The San Pedro and Lakewood formations are similarly folded across the uplift, and the folds developed in these sediments generally correspond to the underlying structures.

The Lakewood formation is exposed on-site at the surface and includes what has previously been termed "terrace deposits," "Palos Verdes sand," and "unnamed upper Pleistocene deposits." Maximum thickness of this formation has been measured to be about 340 feet at Lakewood, California. Materials range in size from cobbles to clay, with fine deposits separating the lenticular

sandy and gravelly beds.

Site Specific Geology - The WDI soil boring logs and cross sections indicate that WDI strata consist of fluvial deposits. The soils are coarse grained, occasionally pebbly, channelized sands surrounded in places by finer grained, lower energy, and laterally extensive beds. This suggests a braided river system depositional environment. The variable thickness (3-20 feet) and variable lateral extent (30-1500+ feet) of individual channel deposits below the site is a result of the continuous active fluvial channel-cutting/depositing events.

Regional Hydrogeology - The WDI site is situated in the Whittier Area of the Central Groundwater Basin. The Whittier Area is overlain by the La Habra Piedmont slope and part of the Santa Fe Springs Plain and the Coyote Hills. The known water-bearing sediments, extending to a depth of about 1,000 feet (800 feet below sea level), include Recent alluvium and the Lakewood and San Pedro formations (Figure 2.6). A part of the underlying Pliocene and older deposits may also contain water of good quality. Electric logs of oil wells indicate fresh water at a greater depth than has been penetrated by water wells.

Site-Specific Hydrogeology - The local hydrogeology is described based on information extracted from the boring logs and the water level elevations. In general, groundwater has been encountered at a depth of 46 to 65 feet below ground surface and from 91 to 106 feet above mean sea level. Accordingly, groundwater is approximately 34 to 44 feet below the bottom of the reservoir and 22 to 47 feet below the waste handling areas. The general direction of the groundwater flow is to the south and southwest (Figure 2.7).

3.0 MAPS AND FIGURES

Figure 2.1: Site Location map

Figure 2.2: WDI site and monitoring well locations

Figure 2.3: 1958 Aerial photo of WDI site

Figure 2.4: Land Use Map

Figure 2.5: Regional Geology

Figure 2.6: Regional Aquifer Cross Section

Figure 2.7: Groundwater Level Contour Map, December 1991

Figure 5.1: Water level elevation changes, 1992

4.0 METHODS AND SCOPE OF WORK

The methods used for collection and analysis of groundwater samples and water level measurements for this investigation are outlined in the document, Superfund Field Sampling and Analysis Plan, Waste Disposal Incorporated, Santa Fe Springs, California, 1992, U.S. EPA Region IX, Laboratory Support Section. Summarized below are the procedures that were followed and any deviations from the sample plan.

Quarterly groundwater sampling at the WDI site was performed by personnel of the U.S. EPA, Environmental Services Branch, during the months of February, May, and August of 1992. Eight shallow wells and three medium level wells were sampled during this investigation. In addition to the eleven groundwater samples collected, the following field quality control samples were also collected: field duplicate samples from well GW-1 and GW-7, two equipment blanks and one field blank.

Well purging was conducted with either a decontaminated PVC bailer or decontaminated piston pump. Well sampling was conducted with decontaminated teflon bailers. Prior to sampling each well, the water level was measured and the well was purged by removing at least three well volumes of water. Electrical conductivity, pH, and temperature were monitored and allowed to stabilize prior to sample collection.

The samples collected were sent for laboratory analysis to either the U.S. EPA Region 9 laboratory in Las Vegas, or a laboratory in the Superfund Contract Laboratory Program (CLP). The following analyses were performed on the groundwater samples collected during these three sampling events:

Organic Analyses: Volatile Organics
 Semi-volatile organics
 Pesticides/PCBs

Inorganic Analyses: Total Metals
 Dissolved Metals

In addition, the following field measurements were made: pH, conductivity, temperature, and turbidity (Table 4.1).

Problems in the field or deviations from the procedures outlined in the sample plan are listed below:

February 1992: Well GW-9, which was originally included in the sampling network, was not sampled. Excessive rain prior to and during the sampling event left a pool of standing water over the well cover. During an attempt to sample, some stormwater run-off entered the well; therefore, this well was deleted from the 1992 sampling schedule due to the possibility of cross-contamination

from stormwater run-off.

May 1992: De-ionized water was used in place of tap water in the decontamination procedure. Due to uncertain quality of locally available tapwater, it was determined that all water for decon should be of de-ionized quality or better. The lock on well GW-04 was rusted shut; WD-40 was used to loosen it. Only 1.9 well volumes were purged from well GW-28 due to sampler's miscalculation of well volume; however, the pH, temperature, and conductivity readings were stable prior to sampling.

August 1992: The locks on wells GW-7 and GW-26 were rusted shut; WD-40 was used to loosen them.

5.0 RESULTS OF ANALYSES

A summary of the results of the 1992 groundwater investigation is discussed below. The following wells were each sampled three times during 1992: GW-1, 2, 4, 7, 10, 11, 23, 24, 26, 28, 30.

5.1 GROUNDWATER ELEVATIONS

Water levels in all the wells (27 total) were measured in December 1991, and a groundwater elevation contour map was prepared (see figure 2.7). No significant change from previous groundwater elevation contour maps was found; groundwater flow is generally south and southwest through the site.

Water levels were measured at each well sampled during each sampling event (Table 5.1). Water levels were measured before purging and after sampling each well, and no significant drawdown was detected in any well. From December 1991 to August 1992, the water level increased in all wells (Figure 5.1). The increase is most apparent between the February and May events, in which the water level rose by an average of 1.23 feet.

5.2 GROUNDWATER QUALITY

Volatile Organics The following volatile organics were detected:

<u>Well #</u>	<u>Date</u>	<u>Amount (ppb)</u>	<u>Qualifier</u>	<u>Contaminant</u>
11	5/92	1	J	Bromodichloromethane
11	5/92	8	J	Tetrachloroethene
11	8/92	17	N	Tetrachloroethene
26	2/92	8	J	Trichloroethene
26	5/92	7	J	Trichloroethene
7	5/92	1	J	Carbon disulfide
7	8/92	41	N	2-Butanone (MEK)
24	2/92	2	J	Tetrachloroethene

"J" qualifier indicates that values are estimated; data is valid for limited purposes. The results are qualitatively acceptable unless otherwise noted. "N" qualifier indicates presumptive evidence of the presence of the material. Compound identification is considered to be tentative, and the data are usable for limited purposes.

The presence of tetrachloroethene in well GW-11 and trichloroethene in well GW-26 confirm previous results. Bromodichloromethane in well GW-11 and carbon disulfide in well GW-7 were both found at a level of 1ppb during the May sampling event, and are probably mis-identified compounds. These compounds were not found in any other well at any time. The finding of 2-Butanone (MEK) in well GW-7 was probably caused by field contamination, as WD-40 was used to loosen the lock on this well during the August sampling event. MEK was not found in any other well at any time.

Acetone, chloroform, toluene, and methylene chloride were found in several wells and blanks, and were probably caused by field and lab contamination. None of these compounds were found in the wells above the levels found in the field and equipment blanks.

Semi-volatile Organics- Several phthalates, including Di-n-butylphthalate, bis(2-Ethylhexyl)phthalate, and butylbenzylphthalate were found at low levels in the blanks and samples. These are common laboratory contaminants and are probably artifacts.

Pesticides/PCBs- No pesticides/PCBs were detected in any wells.

Metals- Both total and dissolved metals were found in all the wells. Samples were analyzed for total and dissolved (filtered) metals. The use of total metals data is considered to be more

protective of human health, but may result in a high bias due to particulates (sediment) in the groundwater, which is not normally a component of drinking water. Dissolved metals are obtained by filtering the sample through a 0.45u filter. The filtered samples are more representative of drinking water, and of groundwater that is in a mobile phase.

The following metals were detected in some or all of the wells: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, vanadium, and zinc. Tabular results are presented in Table 5.2, and graphed in Appendix A. The average values listed in the Table 5.2 and the graphs in Appendix A were determined by computing the mean of quantifiable metals (i.e., non-detects were not included in the averages). Non-detects are shown in Appendices B, C, and D with a "U" qualifier. The "U" qualifier indicates that the metal was not detected above the Instrument Detection Limit (IDL).

Aluminum (total) ranging from 2-28 ppm was found in all the shallow wells; in two deep wells, aluminum was detected below 1 ppm. Dissolved aluminum was not found in any well.

Antimony (total) was found in shallow wells GW-1 and GW-28 during the August sampling event at approximately 15ppb; dissolved antimony was detected in well GW-1 during the August event, and wells GW-2 and 30 in February.

Arsenic (total) was found in most of the shallow wells at levels below the MCL (currently 50ppb); in the dissolved form, arsenic was only found in GW-11.

Barium (total) was found in all the wells at levels from 30-500 ppb, but below the MCL of 1000ppb. Dissolved barium was uniformly found in all the wells at less than 50 ppb.

Beryllium (total) was found in all wells at levels below 1.1 ppb. As a dissolved constituent, beryllium was found at higher levels (up to 2.2ppb) in all the wells.

Calcium (total) was found in all wells to 300 ppm, and as a dissolved constituent at similar levels in all wells.

Cadmium (total) was detected in six of eight of the shallow wells during the February sampling event at levels ranging from 5.4 to 14.2 ppb, all above the MCL of 5ppb. Cadmium was not detected in any wells during the May or August sampling events. Dissolved cadmium was not found in any well.

Chromium (total) was found in all wells at levels approaching the MCL of 50ppb; as a dissolved constituent, chromium was found below 10ppb in 9 of the 11 wells.

Cobalt (total) was found in five shallow wells to 24ppb, and not found in any deep wells. Dissolved cobalt was not found in any well.

Copper (total) was found in all wells, but at levels far below the MCL of 1000 ppb; as a dissolved constituent, copper was found below 10 ppb in several wells.

Iron (total) was found in all the shallow wells at levels greatly exceeding the MCL of 300ppb, and in the deep wells at levels near the MCL. As a dissolved constituent, iron was found in all wells at levels very far below the MCL.

Lead (total) was found in several wells at levels approaching the 20 ppb MCL, and exceeding the MCL in GW-01 in February. As a dissolved constituent, lead was detected in most of the wells, but at levels far below the MCL.

Magnesium was found in all wells, as both a total and dissolved constituent.

Manganese (total) was found in all shallow wells at levels greatly exceeding the MCL (secondary), and in deep wells near the MCL. As a dissolved constituent, manganese was found at very high levels in well GW-10, and at lower levels in most of the other wells.

Mercury (total) was detected in eight wells below the MCL of 2ppb, and in six wells as a dissolved constituent, also below the MCL.

Nickel (total) was found in all wells except GW-2, 7, and 24. As a dissolved metal, nickel was found in GW-2, 7, and 24, but not in GW-4, 10, 11, 26, and 30.

Potassium (total) was found in all wells, and at similar levels as a dissolved metal.

Selenium (total) was found in all wells at levels exceeding the MCL of 10 ppb. As a dissolved metal, selenium was found in all wells at levels exceeding the MCL. Values ranged from 11.9 to 89.7 ppb.

Sodium (total) was found in all wells, and at similar levels as a dissolved constituent.

Vanadium was found as a total and dissolved metal in both shallow and deep wells; no MCL has been set.

Zinc (total) was found in all wells at levels greatly below the MCL of 5ppm; as a dissolved metal, zinc was also found below the MCL.

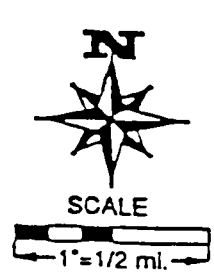
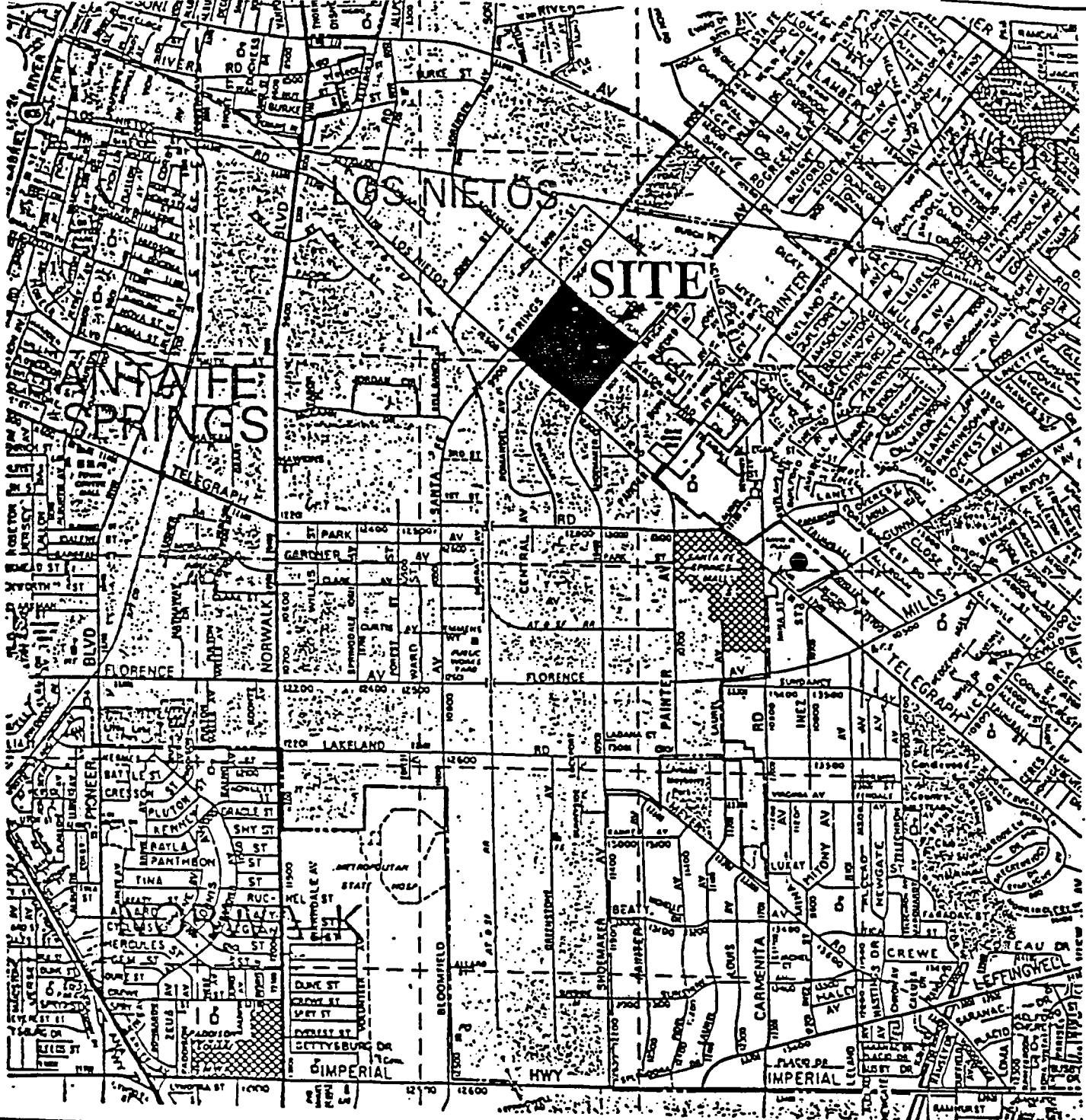
6.0 CONCLUSIONS

Data collected during the 1992 monitoring is consistent with previous investigations at WDI with respect to both the hydrology and chemical properties. In particular, the presence of low levels of trichloroethene and tetrachloroethene was confirmed.

The presence of metals in the groundwater beneath the site was confirmed. Total (unfiltered) metals were found at levels exceeding the Safe Drinking Water Act Maximum Contaminant Limit (MCL) for cadmium, chromium, iron, lead (one well), manganese, and selenium. Dissolved (filtered) metals were found at levels exceeding the MCL for manganese and selenium.

The use of total metals data is considered to be more protective of human health, but may result in a high bias due to particulates (sediment) in the groundwater, which is not normally a component of drinking water. Dissolved metals are obtained by filtering the sample through a 0.45u filter. The filtered samples are more representative of drinking water, and of groundwater that is in a mobile phase.

Cadmium, chromium, lead, and selenium are primary MCLs, and iron and manganese are both secondary MCLs. Primary MCLs are health-based, enforceable standards; secondary MCLs are generally associated with aesthetic qualities such as taste, odor, or color.



SOURCE: Adapted from Thomas Brothers Guide, 1988.

Figure 2.1 Site location map

0 100

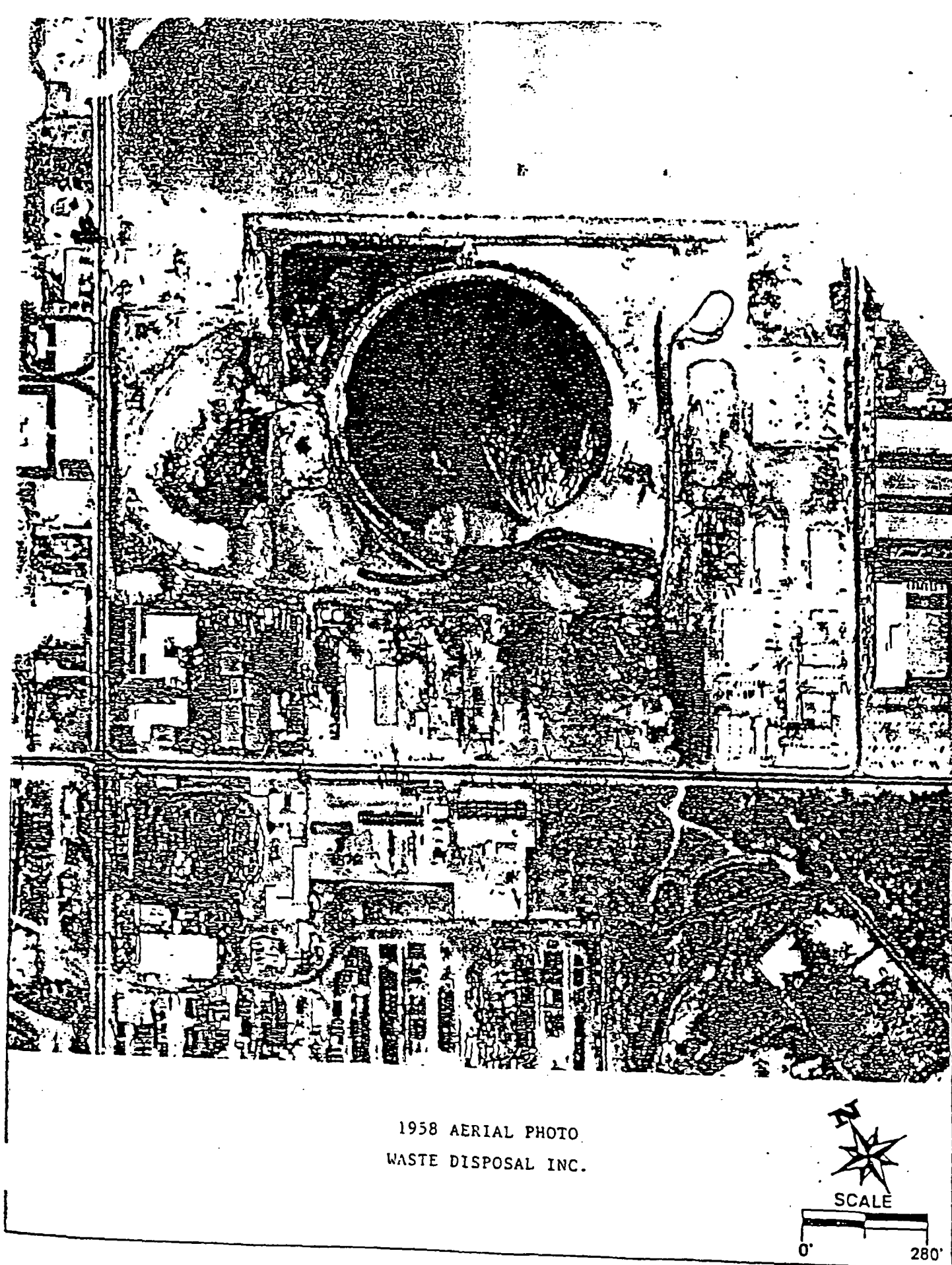


Figure 2.3 1958 Aerial photo of WDI site

LAND USE MAP WASTE DISPOSAL INC.

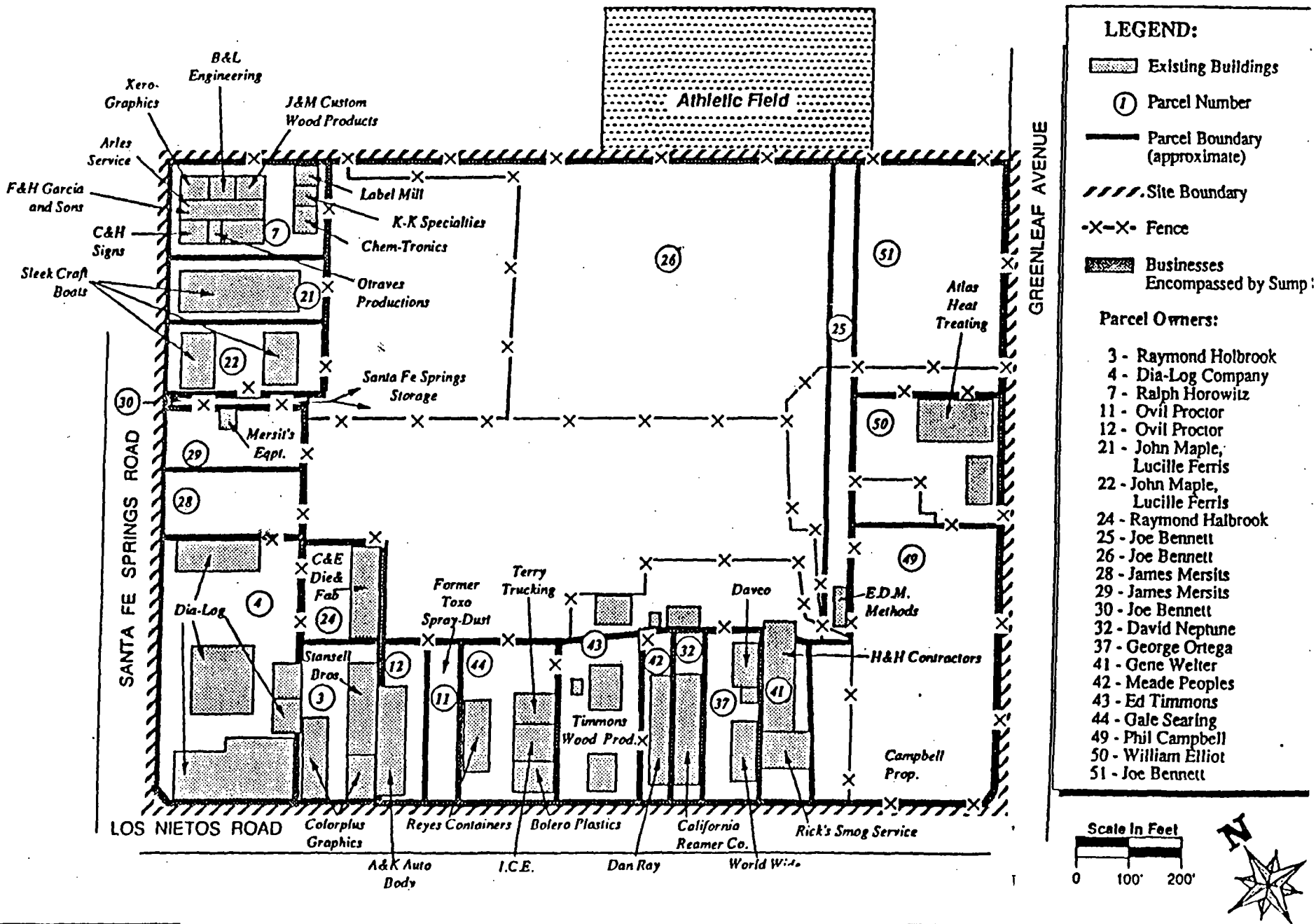


Figure 2.4 Land Use Map

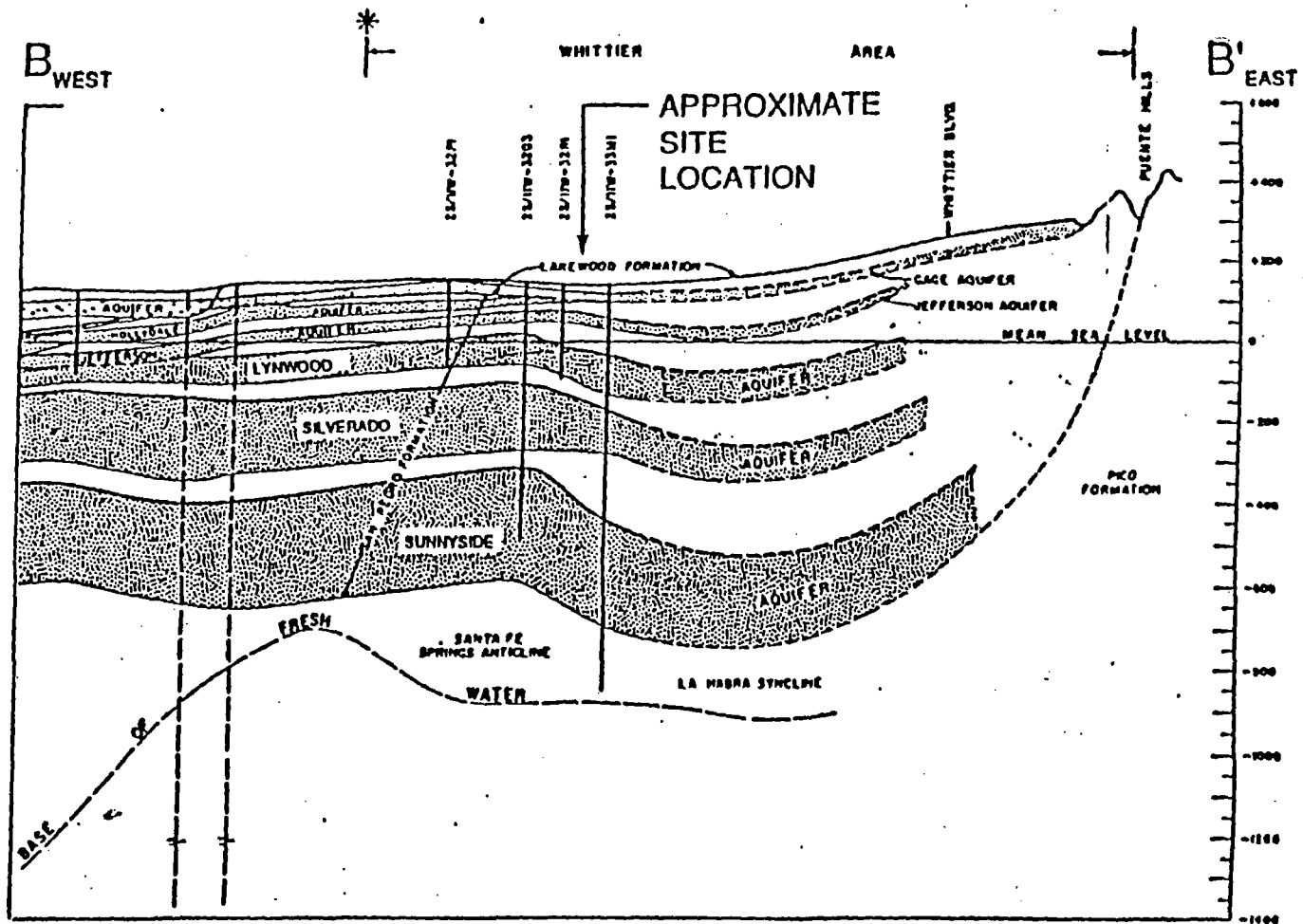


Figure 2.6 Regional Aquifer Cross Section

SOURCE: Adapted from DWR (1961).

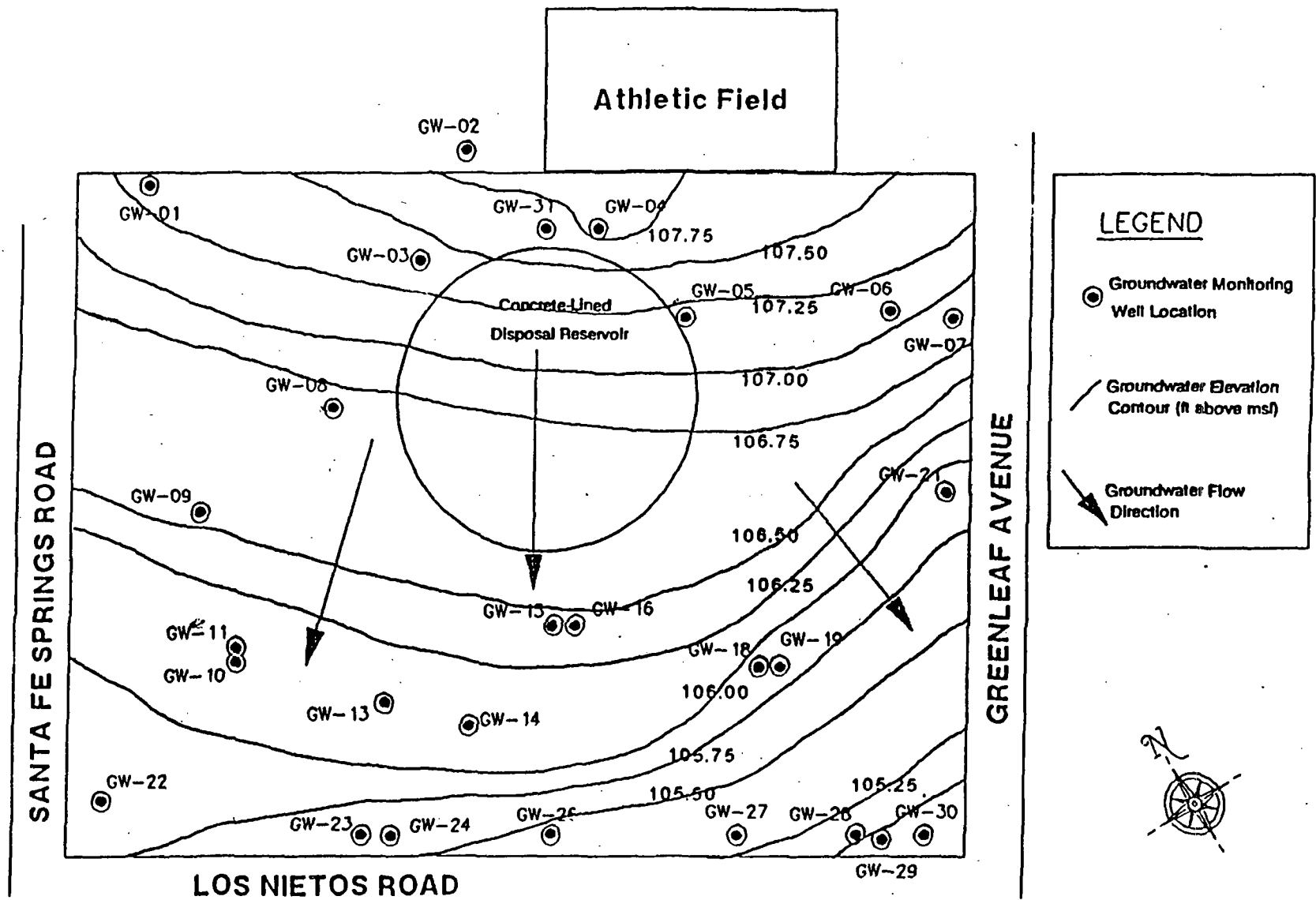


Figure 2.7 Groundwater Level Contour Map, December 1991

WASTE DISPOSAL, INCORPORATED
1992 FIELD MEASUREMENTS

PARAMETER	pH			CONDUCTIVITY (umhos/cm)			TEMPERATURE (C)			TURBIDITY (NTU)		
WELL/DATE	2/92	5/92	8/92	2/92	5/92	8/92	2/92	5/92	8/92	2/92	5/92	8/92
GW-01	6.00	7.11	7.35	2140	2080	2480	22.00	22.00	22.30	NM	99.00	37.00
GW-02	7.16	6.91	7.25	1776	1970	2250	19.00	21.00	22.60	88.10	61.30	39.00
GW-04	6.42	6.65	6.97	1648	2020	1655	19.00	21.00	21.70	NM	187.50	>200
GW-07	6.80	6.43	7.27	1700	2480	2440	21.60	22.50	23.00	10.29	17.42	44.10
GW-10	7.68	6.50	6.90	1780	2100	1920	21.00	22.10	22.60	NM	>200	42.00
GW-11	6.12	6.89	7.18	1900	2400	2220	21.00	22.40	23.40	1.57	4.80	1.50
GW-23	6.93	7.10	7.16	NM	2110	2280	19.80	22.00	24.90	47.40	63.20	95.00
GW-24	6.95	7.05	7.31	NM	2060	2710	20.20	21.60	23.00	2.33	1.75	NM
GW-26	6.66	6.40	6.61	1730	1930	2270	20.30	22.50	23.00	NM	42.00	99.00
GW-28	6.60	6.94	6.58	2030	2300	2390	21.00	22.30	26.00	>200	>200	>200
GW-30	7.12	7.20	7.37	1503	1587	1750	19.90	21.50	22.80	7.70	4.40	4.76

NM = Not Measured

TABLE 4.1 FIELD MEASUREMENTS

WASTE DISPOSAL, INCORPORATED
WATER LEVEL ELEVATIONS
FEET ABOVE MEAN SEA LEVEL

LOCATION	SURFACE ELEVATION	OCT 88 TO								
		OCT 88*	DEC 91	CHANGE	FEB 92	DEC to FEB CHANGE	MAY 92	FEB to MAY CHANGE	AUG 92	MAY TO AUG CHANGE
GW-01	153.76	106.86	107.52	+0.66	108.26	+0.74	109.72	+1.46	110.58	+0.86
GW-02	149.61	107.41	107.85	+0.44	108.46	+0.61	109.87	+1.41	110.67	+0.80
GW-04	167.01	107.51	107.77	+0.26	108.29	+0.52	109.65	+1.36	110.51	+0.86
GW-07	154.78	106.68	106.80	+0.12	107.40	+0.60	108.71	+1.31	109.45	+0.74
GW-10	154.98	105.68	106.40	+0.72	107.04	+0.64	108.38	+1.34	109.15	+0.77
GW-11	154.91	105.01	105.95	+0.94	106.71	+0.76	107.93	+1.22	108.70	+0.77
GW-23	157.23	97.83	98.65	+0.82	98.99	+0.34	99.59	+0.60	100.05	+0.46
GW-24	157.03	92.63	92.70	+0.07	93.31	+0.61	94.51	+1.20	95.57	+1.06
GW-26	156.29	104.89	105.69	+0.80	106.20	+0.51	107.41	+1.21	108.23	+0.82
GW-28	157.56	103.76	105.26	+1.50	105.75	+0.49	107.02	+1.27	107.76	+0.74
GW-30	157.01	101.61	104.47	+2.86	105.11	+0.64	106.29	+1.18	107.01	+0.72
AVERAGE (FEET)				+0.84		+0.59		+1.23		+0.78

* Oct 88 water level measurement from final Remedial Investigation
Report (EBASCO Services Inc), Nov. 1989

TABLE 5.1 WATER LEVEL ELEVATIONS

WASTE DISPOSAL, INCORPORATED

WATER LEVEL ELEVATIONS

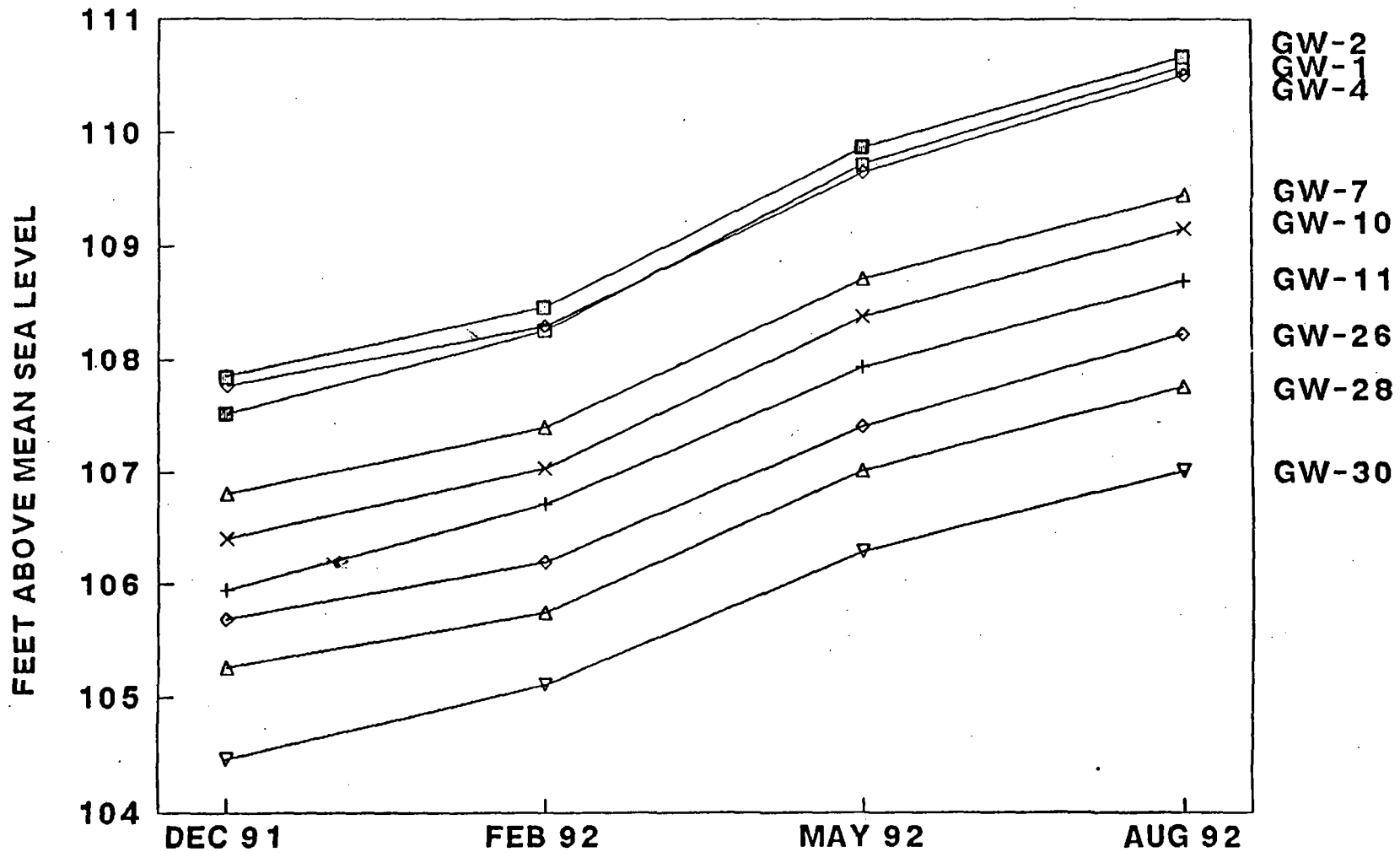


Figure 5.1 Water Level Elevations

WDI TOTAL METALS
ppb (parts per billion)

LOCATION	ALUMINUM					ANTIMONY					ARSENIC				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	46700	1620	9590	19303	NR	ND	ND	14.8	14.8	NR	12.7	ND	4.7	8.7	50
GW-02	5630	2950	1690	3423	NR	ND	ND	ND	ND	NR	2.3	ND	ND	2.3	50
GW-04	5750	7180	22000	11643	NR	ND	ND	ND	ND	NR	2	ND	5.8	3.9	50
GW-07	923	1590	1960	1491	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	50
GW-10	30500	9490	3700	14563	NR	ND	ND	ND	ND	NR	15.6	9.5	ND	12.6	50
GW-23	9390	2490	3340	5073	NR	ND	ND	ND	ND	NR	2.2	ND	ND	2.2	50
GW-26	21700	2170	7280	10383	NR	ND	ND	ND	ND	NR	9.9	ND	2.6	6.3	50
GW-28	33500	13200	31300	26000	NR	ND	ND	14.6	14.6	NR	11.8	6.5	6.9	8.4	50
GW-11	476	ND	ND	476	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	50
GW-24	ND	ND	ND	ND	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	50
GW-30	272	111	53	145	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	50

WDI DISSOLVED METALS
ppb (parts per billion)

LOCATION	ALUMINUM					ANTIMONY					ARSENIC				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	ND	ND	ND	ND	NR	ND	ND	12.2	12.2	NR	ND	ND	ND	ND	50
GW-02	ND	ND	ND	ND	NR	29.3	ND	ND	29.3	NR	ND	ND	ND	ND	50
GW-04	ND	ND	ND	ND	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	50
GW-07	ND	ND	ND	ND	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	50
GW-10	ND	ND	ND	ND	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	50
GW-23	ND	ND	ND	ND	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	50
GW-26	ND	ND	ND	ND	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	50
GW-28	ND	ND	ND	ND	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	50
GW-11	ND	ND	ND	ND	NR	ND	ND	ND	ND	NR	ND	ND	2.2	2.2	50
GW-24	ND	ND	ND	ND	NR	ND	ND	ND	ND	NR	ND	ND	ND	ND	50
GW-30	ND	ND	ND	ND	NR	29.5	ND	ND	29.5	NR	ND	ND	ND	ND	50

Table 5.2

WDI TOTAL METALS
ppb (parts per billion)

LOCATION	BARIUM					BERYLLIUM					CADMIUM				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	707.0	64.7	149.0	306.9	1000	3.3	ND	1.6	2.5	NR	14.2	ND	ND	14.2	5
GW-02	147.0	110.0	40.7	99.2	1000	1.3	ND	1.2	1.3	NR	ND	ND	ND	ND	5
GW-04	114.0	159.0	286.0	186.3	1000	1.3	1.3	1.8	1.5	NR	5.4	ND	ND	5.4	5
GW-07	68.4	87.0	58.2	71.2	1000	1.1	ND	1.1	1.1	NR	ND	ND	ND	ND	5
GW-10	724.0	382.0	108.0	404.7	1000	2.3	1.4	1.2	1.6	NR	8.2	ND	ND	8.2	5
GW-23	269.0	89.5	67.4	142.0	1000	1.6	ND	1.2	1.4	NR	6.0	ND	ND	6.0	5
GW-26	585.0	108.0	199.0	297.3	1000	2.1	1.1	1.3	1.5	NR	7.0	ND	ND	7.0	5
GW-28	315.0	201.0	308.0	274.7	1000	2.8	1.2	2.3	2.1	NR	9.6	ND	ND	9.6	5
GW-11	88.8	26.2	ND	57.5	1000	1.3	ND	1.3	1.3	NR	ND	ND	ND	ND	5
GW-24	49.2	23.8	ND	36.5	1000	1.5	ND	1.3	1.4	NR	ND	ND	ND	ND	5
GW-30	65.2	40.5	33.1	46.3	1000	1.1	ND	0.9	1.0	NR	ND	ND	ND	ND	5

WDI DISSOLVED METALS
ppb (parts per billion)

LOCATION	BARIUM					BERYLLIUM					CADMIUM				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	53.6	21.5	ND	37.6	1000	1.3	ND	1.0	1.2	NR	ND	ND	ND	ND	5
GW-02	51.0	28.0	ND	39.5	1000	1.1	ND	0.4	0.8	NR	ND	ND	ND	ND	5
GW-04	46.4	21.7	ND	34.1	1000	0.9	ND	0.7	0.8	NR	ND	ND	ND	ND	5
GW-07	46.6	18.1	ND	32.4	1000	1.1	ND	0.8	1.0	NR	ND	ND	ND	ND	5
GW-10	47.6	24.7	ND	36.2	1000	1.0	1.0	0.8	0.9	NR	ND	ND	ND	ND	5
GW-23	49.4	25.1	ND	37.3	1000	1.2	ND	0.8	1.0	NR	ND	ND	ND	ND	5
GW-26	55.5	26.0	ND	40.8	1000	1.1	ND	0.8	1.0	NR	ND	ND	ND	ND	5
GW-28	57.2	30.6	10.2	32.7	1000	1.3	ND	1.0	1.2	NR	ND	ND	ND	ND	5
GW-11	54.1	22.5	ND	38.3	1000	1.1	1.1	0.9	1.0	NR	ND	ND	ND	ND	5
GW-24	49.8	24.3	ND	37.1	1000	1.1	ND	0.9	1.0	NR	ND	ND	ND	ND	5
GW-30	60.1	40.0	20.2	40.1	1000	0.9	ND	0.5	0.7	NR	ND	ND	ND	ND	5

Table 5.2

WDI TOTAL METALS
ppb (parts per billion)

LOCATION	CALCIUM					CHROMIUM					COBALT				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	315000	278000	294000	295667	NR	81.6	9.3	19.9	36.9	50	50.7	ND	10.7	30.7	NR
GW-02	218000	208000	220000	215333	NR	13.8	10.8	7.9	10.8	50	ND	ND	ND	ND	NR
GW-04	204000	196000	197000	199000	NR	16.5	18.9	39.6	25.0	50	ND	ND	20.0	20.0	NR
GW-07	220000	226000	219000	221667	NR	ND	3.9	6.5	5.2	50	ND	ND	ND	ND	NR
GW-10	238000	225000	233000	232000	NR	41.6	18.1	5.3	21.7	50	36.3	18.0	6.9	20.4	NR
GW-23	250000	232000	231000	237667	NR	15.2	5.6	6.4	9.1	50	ND	ND	ND	ND	NR
GW-26	254000	243000	250000	249000	NR	33.4	6.6	11.5	17.2	50	33.7	ND	12.4	23.1	NR
GW-28	285000	253000	277000	271667	NR	55.1	21.6	49.1	41.9	50	29.8	12.7	29.2	23.9	NR
GW-11	257000	277000	273000	269000	NR	4.9	5.9	3.1	4.6	50	ND	ND	ND	ND	NR
GW-24	288000	205000	288000	260333	NR	5.5	3.1	3.9	4.2	50	ND	ND	ND	ND	NR
GW-30	182000	159000	156000	165667	NR	4.1	5.2	ND	4.7	50	ND	ND	ND	ND	NR

WDI DISSOLVED METALS
ppb (parts per billion)

LOCATION	CALCIUM					CHROMIUM					COBALT				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	313000	287000	279000	293000	NR	ND	7.4	4.6	6.0	50	ND	ND	ND	ND	NR
GW-02	234000	208000	204000	215333	NR	8.5	7.1	6.6	7.4	50	ND	ND	ND	ND	NR
GW-04	207000	194000	183000	194667	NR	6.1	9.2	5.1	6.8	50	ND	ND	ND	ND	NR
GW-07	238000	204000	210000	217333	NR	ND	3.3	ND	3.3	50	ND	ND	ND	ND	NR
GW-10	227000	226000	221000	224667	NR	ND	ND	ND	ND	50	ND	ND	ND	ND	NR
GW-23	273000	239000	232000	248000	NR	ND	ND	ND	ND	50	ND	ND	ND	ND	NR
GW-26	257000	242000	239000	246000	NR	ND	ND	2.1	2.1	50	ND	ND	ND	ND	NR
GW-28	287000	245000	260000	264000	NR	ND	3.7	ND	3.7	50	ND	ND	ND	ND	NR
GW-11	274000	268000	277000	273000	NR	ND	5.9	2.3	4.1	50	ND	ND	ND	ND	NR
GW-24	264000	221000	281000	255333	NR	ND	3.8	4.2	4.0	50	ND	ND	ND	ND	NR
GW-30	188000	162000	153000	167667	NR	ND	3.8	2.5	3.2	50	ND	ND	ND	ND	NR

Table 5.2

WDI TOTAL METALS
ppb (parts per billion)

LOCATION	COPPER					IRON					LEAD				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	87.1	14.5	20.5	40.7	1000	70700	2070	15000	29257	300	26.8	2.2	2.4	10.5	20
GW-02	7.7	41.5	5.5	18.2	1000	7990	4450	2900	5113	300	2.4	3.4	1.8	2.5	20
GW-04	11.3	23.8	42.7	25.9	1000	8120	8280	35000	17133	300	3.7	7.2	17.7	9.5	20
GW-07	ND	13.3	6.3	9.8	1000	1320	2520	3160	2333	300	ND	1.3	ND	1.3	20
GW-10	85.8	28.8	9.5	41.4	1000	45400	13700	5970	21690	300	17.4	8.7	2.1	9.4	20
GW-23	20.0	16.2	9.5	15.2	1000	11800	3270	4900	6657	300	2.1	1.7	ND	1.9	20
GW-26	58.1	14.1	19.0	30.4	1000	32800	3570	11900	16090	300	17.8	2.8	3.9	8.2	20
GW-28	71.2	60.8	64.4	65.5	1000	46600	17200	46600	36800	300	13.7	11.1	6.6	10.5	20
GW-11	7.3	8.5	3.6	6.5	1000	1110	204	145	486	300	5.1	ND	ND	5.1	20
GW-24	ND	5.4	2.4	3.9	1000	78	106	69	84	300	ND	1.3	ND	1.3	20
GW-30	ND	4.5	2.8	3.7	1000	695	201	208	368	300	1.0	3.6	2.2	2.3	20

WDI DISSOLVED METALS
ppb (parts per billion)

LOCATION	COPPER					IRON					LEAD				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	ND	6.9	ND	6.9	1000	ND	104	ND	104	300	1.0	ND	ND	1.0	20
GW-02	ND	6.5	ND	6.5	1000	ND	68	ND	68	300	ND	1.4	ND	1.4	20
GW-04	ND	6.4	ND	6.4	1000	ND	79	ND	79	300	ND	2.2	ND	2.2	20
GW-07	ND	4.3	ND	4.3	1000	ND	55	ND	55	300	1.3	1.4	ND	1.4	20
GW-10	ND	6.3	ND	6.3	1000	ND	66	ND	66	300	6.0	ND	ND	6.0	20
GW-23	ND	5.3	ND	5.3	1000	ND	64	ND	64	300	ND	1.2	ND	1.2	20
GW-26	ND	5.5	ND	5.5	1000	ND	69	ND	69	300	1.2	ND	ND	1.2	20
GW-28	ND	6.6	ND	6.6	1000	ND	74	ND	74	300	ND	1.5	ND	1.5	20
GW-11	ND	7.4	ND	7.4	1000	ND	73	ND	73	300	ND	ND	ND	ND	20
GW-24	ND	5.6	ND	5.6	1000	ND	63	ND	63	300	1.3	1.1	ND	1.2	20
GW-30	ND	ND	ND	ND	1000	ND	43	ND	43	300	ND	1.5	ND	1.5	20

Table 5.2

WDI TOTAL METALS
ppb (parts per billion)

LOCATION	MAGNESIUM					MANGANESE					MERCURY				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	112000	85100	94000	97033	NR	2090.0	198.0	430.0	906.0	50.0	0.20	ND	ND	0.20	2.00
GW-02	67500	62700	65000	65067	NR	227.0	241.0	90.0	186.0	50.0	ND	ND	ND	ND	2.00
GW-04	64700	61600	68100	64800	NR	177.0	348.0	687.0	404.0	50.0	ND	0.57	0.30	0.44	2.00
GW-07	70500	71700	69200	70467	NR	144.0	308.0	256.0	236.0	50.0	ND	ND	ND	ND	2.00
GW-10	78100	68400	68400	71633	NR	4190.0	3540.0	2430.0	3386.7	50.0	0.30	ND	ND	0.30	2.00
GW-23	75700	69600	67300	70867	NR	21000.0	876.0	693.0	7523.0	50.0	0.40	ND	0.40	0.40	2.00
GW-26	80900	71400	75200	75833	NR	2640.0	546.0	1010.0	1398.7	50.0	2.00	0.55	0.60	1.05	2.00
GW-28	97600	82700	93000	91100	NR	1010.0	733.0	1050.0	931.0	50.0	0.20	ND	ND	0.20	2.00
GW-11	69900	79500	81500	76967	NR	140.0	87.8	55.4	94.4	50.0	0.20	ND	ND	0.20	2.00
GW-24	81300	59900	80900	74033	NR	3.4	8.3	9.4	7.0	50.0	0.20	ND	ND	0.20	2.00
GW-30	50000	42900	42700	45200	NR	94.4	34.9	19.7	49.7	50.0	ND	ND	ND	ND	2.00

WDI DISSOLVED METALS
ppb (parts per billion)

LOCATION	MAGNESIUM					MANGANESE					MERCURY				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	93900	86700	85500	88700	NR	ND	8.0	ND	8.0	50.0	ND	ND	ND	ND	2.00
GW-02	69200	61900	58600	63233	NR	ND	7.2	0.9	4.1	50.0	ND	ND	ND	ND	2.00
GW-04	62800	58900	56400	59367	NR	ND	11.3	ND	11.3	50.0	0.20	ND	ND	0.20	2.00
GW-07	73500	64300	65400	67733	NR	9.3	33.7	26.4	23.1	50.0	ND	ND	ND	ND	2.00
GW-10	64600	64900	64100	64533	NR	2130.0	2010.0	1950.0	2030.0	50.0	ND	ND	ND	ND	2.00
GW-23	77800	70800	67300	71967	NR	36.7	130.0	290.0	152.2	50.0	ND	ND	0.30	0.30	2.00
GW-26	75800	70200	69500	71833	NR	12.9	19.4	10.9	14.4	50.0	0.30	0.22	1.10	0.54	2.00
GW-28	86200	74300	76500	79000	NR	2.6	14.8	ND	8.7	50.0	0.20	ND	0.40	0.30	2.00
GW-11	73400	77100	78200	76233	NR	6.8	9.6	2.3	6.2	50.0	ND	ND	ND	ND	2.00
GW-24	75300	63900	80900	73367	NR	ND	7.4	ND	7.4	50.0	ND	ND	0.30	0.30	2.00
GW-30	50000	43500	43000	45500	NR	ND	7.8	0.9	4.4	50.0	0.20	ND	ND	0.20	2.00

WDI TOTAL METALS
ppb (parts per billion)

LOCATION	NICKEL					POTASSIUM					SELENIUM				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	69.6	ND	19.7	44.7	NR	16400	5210	8160	9923	NR	42.5	48.8	38.2	43.2	10.0
GW-02	ND	ND	ND	ND	NR	6060	5030	4970	5353	NR	15.7	16.2	20.1	17.3	10.0
GW-04	16.5	15.0	32.0	21.2	NR	6120	5180	9240	6847	NR	21.1	19.5	21.3	20.6	10.0
GW-07	ND	ND	ND	ND	NR	4620	4500	5030	4717	NR	28.0	25.7	4.0	19.2	10.0
GW-10	36.4	18.8	ND	27.6	NR	12300	6620	5970	8297	NR	21.1	18.7	30.2	23.3	10.0
GW-23	21.5	ND	12.9	17.2	NR	6450	4610	4890	5317	NR	22.8	22.6	12.2	19.2	10.0
GW-26	35.6	12.5	17.8	22.0	NR	10200	4940	6930	7357	NR	33.7	32.1	30.5	32.1	10.0
GW-28	54.1	29.4	47.8	43.8	NR	12200	7550	11700	10483	NR	26.5	10.5	46.0	27.7	10.0
GW-11	15.3	ND	ND	15.3	NR	11800	7880	6170	8617	NR	37.8	52.9	39.8	43.5	10.0
GW-24	ND	ND	ND	ND	NR	5500	3370	5550	4807	NR	43.6	18.3	52.0	38.0	10.0
GW-30	14.5	ND	ND	14.5	NR	5170	4340	4630	4713	NR	23.6	26.2	30.5	26.8	10.0

WDI DISSOLVED METALS
ppb (parts per billion)

LOCATION	NICKEL					POTASSIUM					SELENIUM				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	ND	ND	15.4	15.4	NR	6030	5060	5520	5537	NR	33.2	46.4	67.7	49.1	10.0
GW-02	12.9	ND	ND	12.9	NR	5480	4380	4470	4777	NR	14.1	50.5	37.2	33.9	10.0
GW-04	ND	ND	ND	ND	NR	4450	4970	3960	4460	NR	16.1	21.9	17.0	18.3	10.0
GW-07	ND	ND	10.7	10.7	NR	4800	4190	4470	4487	NR	19.1	21.4	30.9	23.8	10.0
GW-10	ND	ND	ND	ND	NR	5160	4620	4710	4830	NR	11.9	46.0	52.9	36.9	10.0
GW-23	ND	ND	11.2	11.2	NR	5270	4540	4110	4640	NR	27.0	21.6	13.0	20.5	10.0
GW-26	ND	ND	ND	ND	NR	5920	4180	4840	4980	NR	26.5	11.9	52.8	30.4	10.0
GW-28	ND	ND	15.5	15.5	NR	5990	5200	5220	5470	NR	20.6	28.0	42.5	30.4	10.0
GW-11	ND	ND	ND	ND	NR	11000	8180	5540	8240	NR	37.8	47.6	89.7	58.4	10.0
GW-24	ND	ND	12.7	12.7	NR	4120	3570	5270	4320	NR	27.4	53.7	87.1	56.1	10.0
GW-30	ND	ND	ND	ND	NR	5170	4110	4770	4683	NR	21.8	30.3	31.4	27.8	10.0

Table 5.2

WDI TOTAL METALS
ppb (parts per billion)

LOCATION	SILVER					SODIUM					THALLIUM				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	ND	ND	ND	ND	50.0	163000	143000	155000	153667	NR	ND	ND	ND	ND	NR
GW-02	ND	ND	ND	ND	50.0	115000	108000	119000	114000	NR	ND	ND	ND	ND	NR
GW-04	ND	ND	ND	ND	50.0	128000	118000	125000	123667	NR	ND	ND	ND	ND	NR
GW-07	ND	ND	ND	ND	50.0	173000	163000	170000	168667	NR	ND	ND	ND	ND	NR
GW-10	ND	ND	ND	ND	50.0	147000	133000	134000	138000	NR	ND	ND	ND	ND	NR
GW-23	ND	ND	ND	ND	50.0	137000	132000	128000	132333	NR	ND	ND	ND	ND	NR
GW-26	ND	ND	ND	ND	50.0	151000	142000	150000	147667	NR	ND	ND	ND	ND	NR
GW-28	ND	ND	ND	ND	50.0	151000	141000	143000	145000	NR	ND	ND	ND	ND	NR
GW-11	ND	ND	ND	ND	50.0	152000	154000	151000	152333	NR	ND	ND	ND	ND	NR
GW-24	ND	ND	ND	ND	50.0	127000	118000	124000	123000	NR	ND	ND	ND	ND	NR
GW-30	ND	ND	ND	ND	50.0	92700	85400	78900	85667	NR	ND	ND	ND	ND	NR

WDI DISSOLVED METALS
ppb (parts per billion)

LOCATION	SILVER					SODIUM					THALLIUM				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	ND	ND	ND	ND	50.0	163000	146000	146000	151667	NR	ND	ND	ND	ND	NR
GW-02	ND	ND	ND	ND	50.0	120000	109000	113000	114000	NR	ND	ND	ND	ND	NR
GW-04	ND	ND	ND	ND	50.0	130000	120000	121000	123667	NR	ND	ND	ND	ND	NR
GW-07	ND	ND	ND	ND	50.0	176000	148000	159000	161000	NR	ND	ND	ND	ND	NR
GW-10	ND	ND	ND	ND	50.0	137000	132000	127000	132000	NR	ND	ND	ND	ND	NR
GW-23	ND	ND	ND	ND	50.0	136000	138000	131000	135000	NR	ND	ND	ND	ND	NR
GW-26	ND	ND	ND	ND	50.0	156000	142000	142000	146667	NR	ND	ND	ND	ND	NR
GW-28	ND	ND	ND	ND	50.0	155000	140000	138000	144333	NR	ND	ND	ND	ND	NR
GW-11	ND	ND	ND	ND	50.0	157000	150000	137000	148000	NR	ND	ND	ND	ND	NR
GW-24	ND	ND	ND	ND	50.0	134000	125000	124000	127667	NR	ND	ND	ND	ND	NR
GW-30	ND	ND	ND	ND	50.0	98500	86300	79900	88233	NR	ND	ND	ND	ND	NR

Table 5.2

WDI TOTAL METALS
ppb (parts per billion)

LOCATION	VANADIUM					ZINC				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	126.0	11.2	30.3	55.8	NR	206.0	19.7	40.9	88.9	5000
GW-02	16.8	12.4	7.6	12.3	NR	25.8	51.6	12.1	29.8	5000
GW-04	16.8	26.0	60.3	34.4	NR	34.4	65.8	111.0	70.4	5000
GW-07	ND	8.5	8.2	8.4	NR	25.8	20.4	12.1	19.4	5000
GW-10	84.4	39.7	12.3	45.5	NR	189.0	74.1	22.8	95.3	5000
GW-23	37.0	10.8	11.4	19.7	NR	51.6	30.3	16.0	32.6	5000
GW-26	60.3	10.7	22.6	31.2	NR	103.0	23.8	41.5	56.1	5000
GW-28	94.2	50.0	88.9	77.7	NR	155.0	101.0	133.0	129.7	5000
GW-11	ND	ND	4.7	4.7	NR	328.0	82.3	23.7	144.7	5000
GW-24	ND	ND	3.9	3.9	NR	ND	24.7	ND	24.7	5000
GW-30	ND	ND	3.9	3.9	NR	17.2	11.7	17.2	15.4	5000

WDI DISSOLVED METALS
ppb (parts per billion)

LOCATION	VANADIUM					ZINC				
	2/92	5/92	8/92	AVG	MCL	2/92	5/92	8/92	AVG	MCL
GW-01	ND	ND	4.2	4.2	NR	15.4	6.1	ND	10.8	5000
GW-02	ND	ND	3.9	3.9	NR	30.7	19.6	ND	25.2	5000
GW-04	ND	ND	2.2	2.2	NR	15.4	237.0	ND	126.2	5000
GW-07	ND	ND	3.6	3.6	NR	ND	7.4	ND	7.4	5000
GW-10	ND	ND	2.5	2.5	NR	15.4	8.6	17.2	13.7	5000
GW-23	ND	ND	3.2	3.2	NR	23.1	12.1	ND	17.6	5000
GW-26	ND	ND	3.1	3.1	NR	30.7	10.7	ND	20.7	5000
GW-28	ND	ND	2.8	2.8	NR	15.4	22.5	ND	19.0	5000
GW-11	ND	ND	4.5	4.5	NR	184.0	62.6	8.3	85.0	5000
GW-24	ND	ND	4.3	4.3	NR	15.4	19.5	ND	17.5	5000
GW-30	ND	ND	3.9	3.9	NR	ND	8.7	11.5	10.1	5000

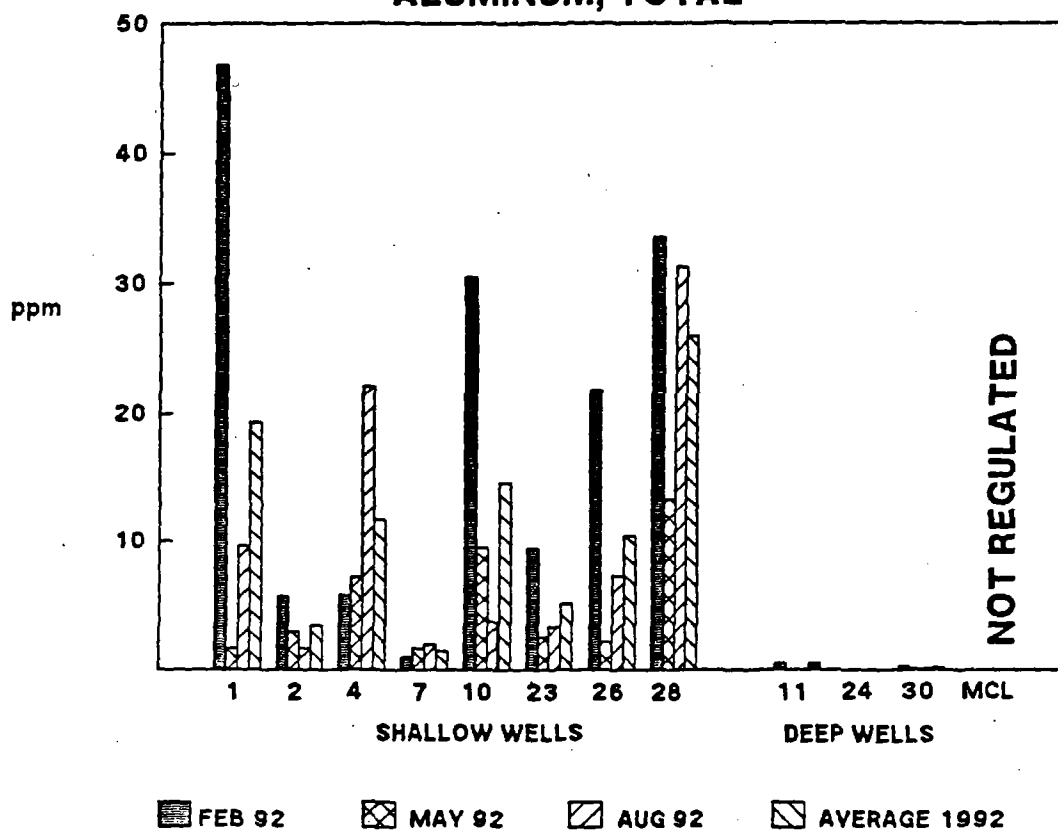
Table 5.2

APPENIX A

GRAPHS - TOTAL AND DISSOLVED METALS

WASTE DISPOSAL, INCORPORATED

ALUMINUM, TOTAL

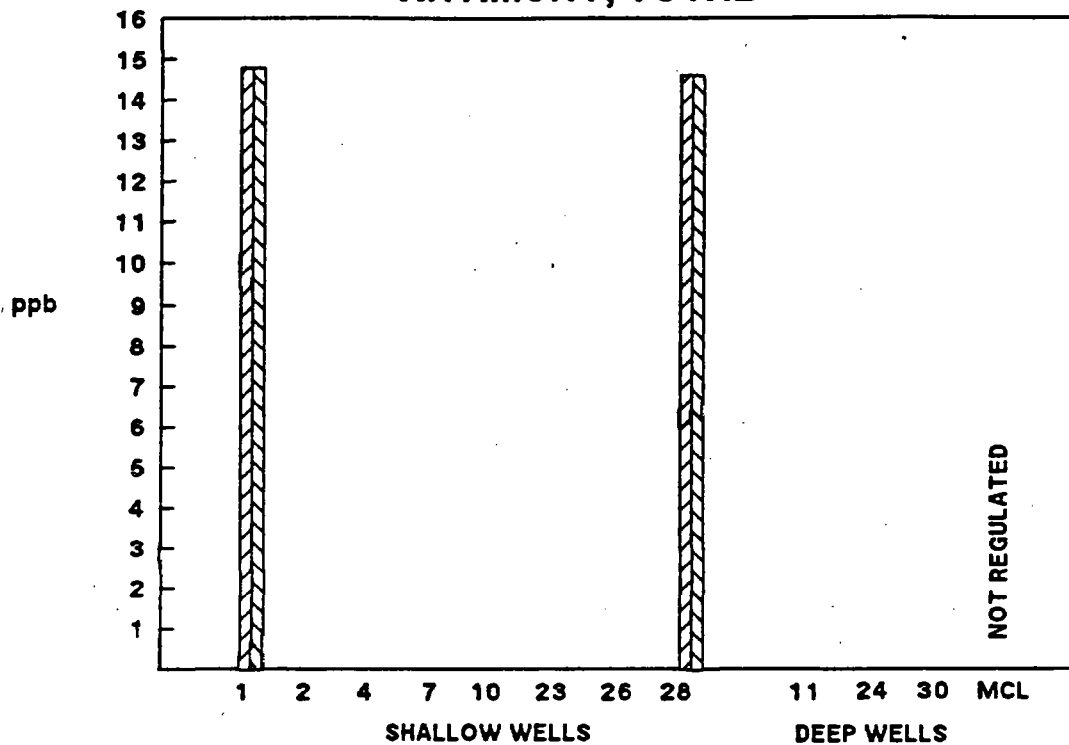


DISSOLVED ALUMINUM

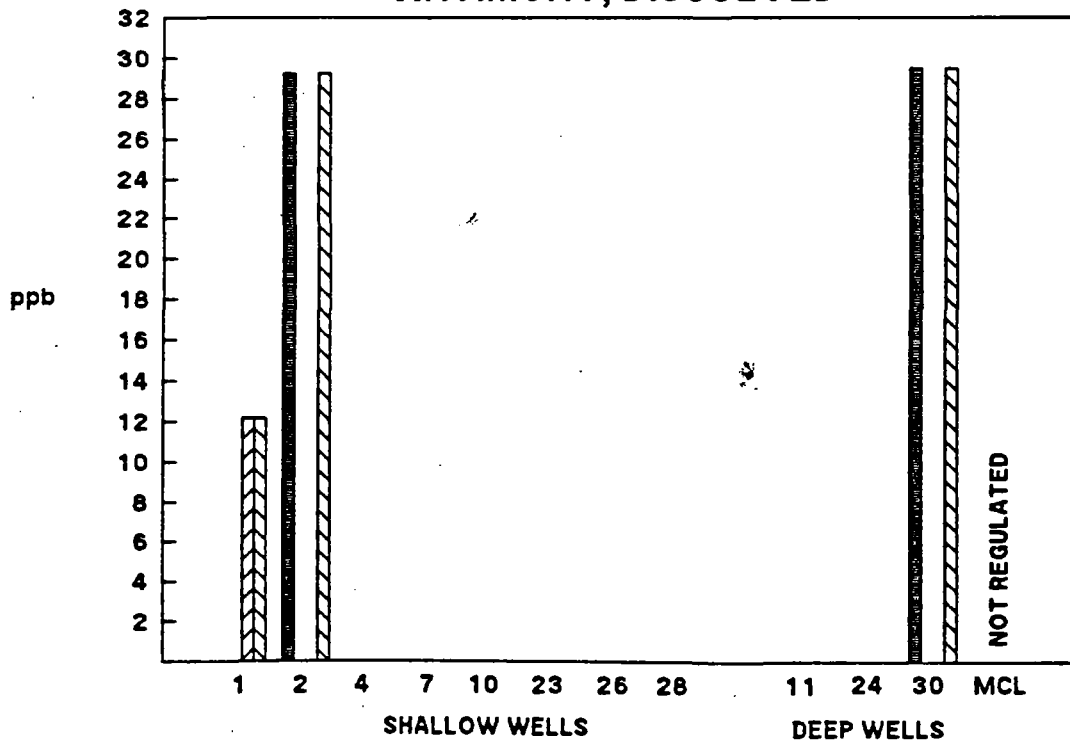
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WASTE DISPOSAL, INCORPORATED

ANTIMONY, TOTAL



ANTIMONY, DISSOLVED



FEB 92

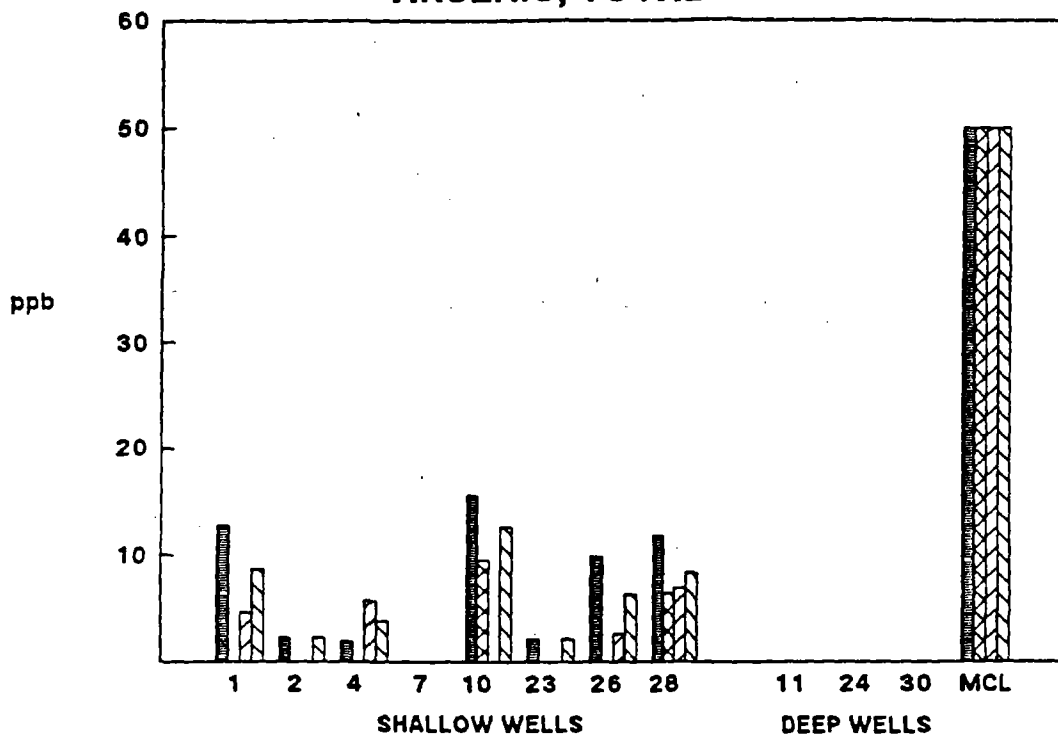
MAY 92

AUG 92

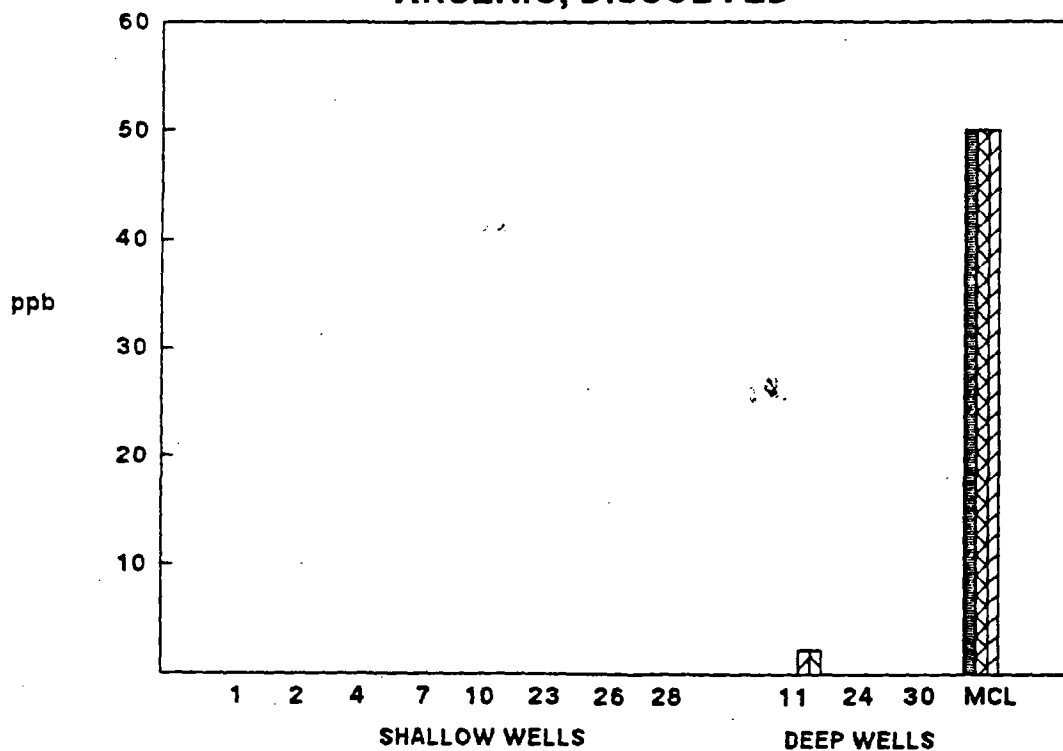
AVERAGE 1992

WASTE DISPOSAL, INCORPORATED

ARSENIC, TOTAL



ARSENIC, DISSOLVED



FEB 92

MAY 92

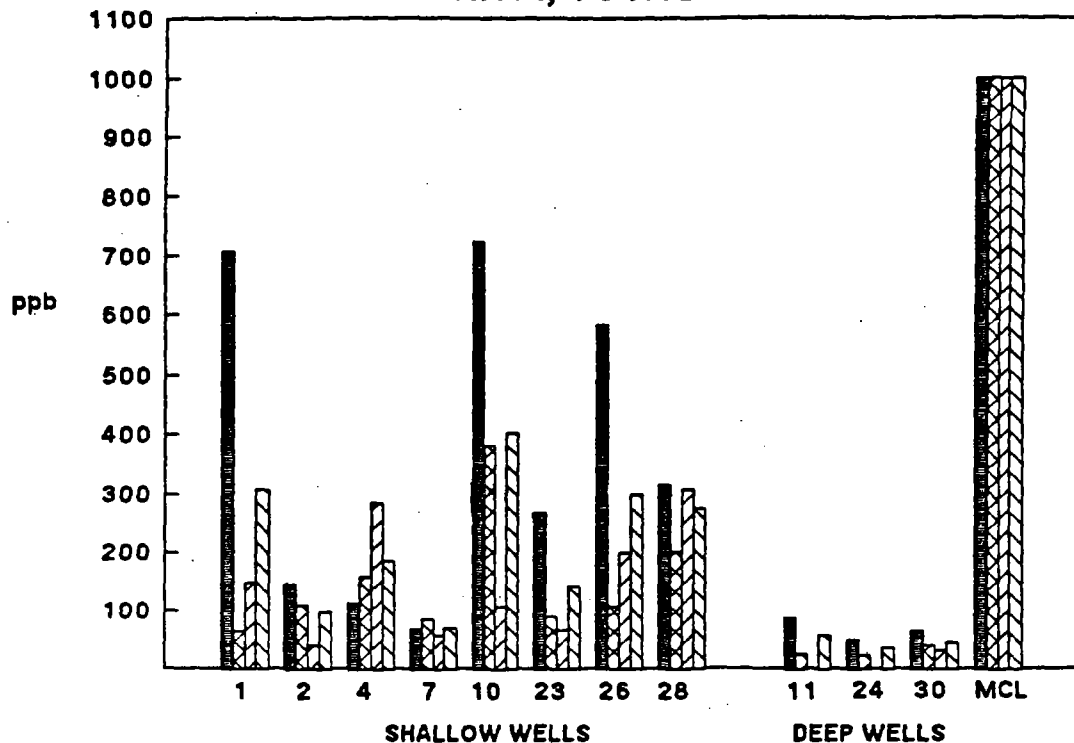
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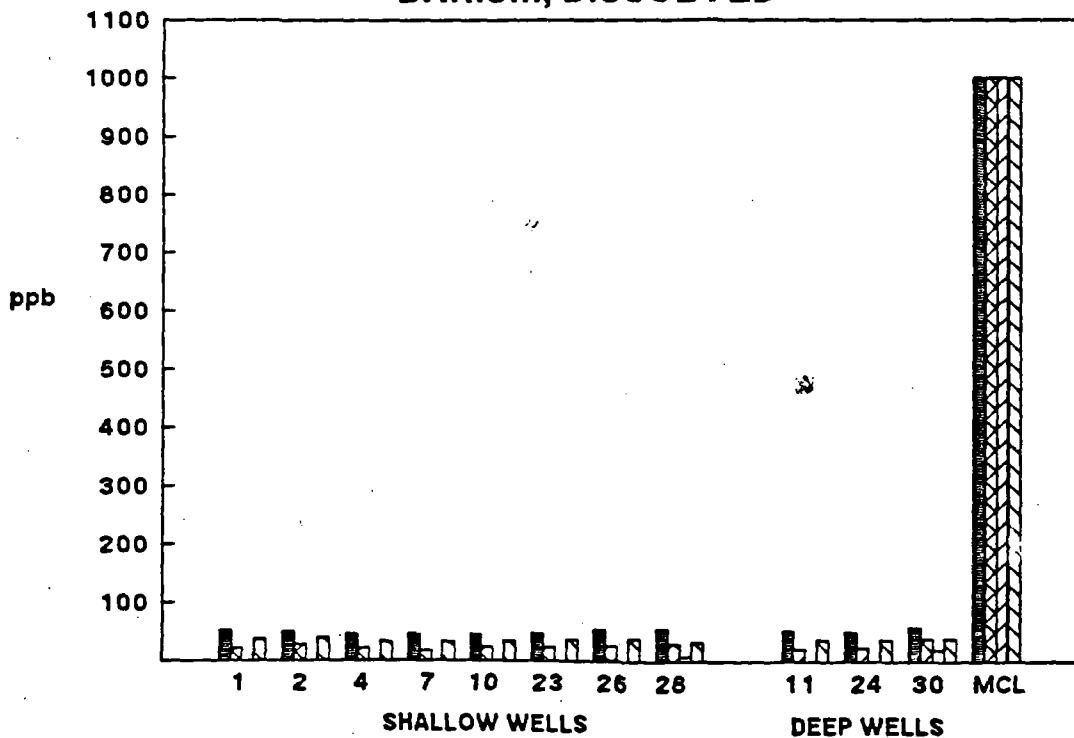
A-3

WASTE DISPOSAL, INCORPORATED

BARIUM, TOTAL



BARIUM, DISSOLVED



FEB 92

MAY 92

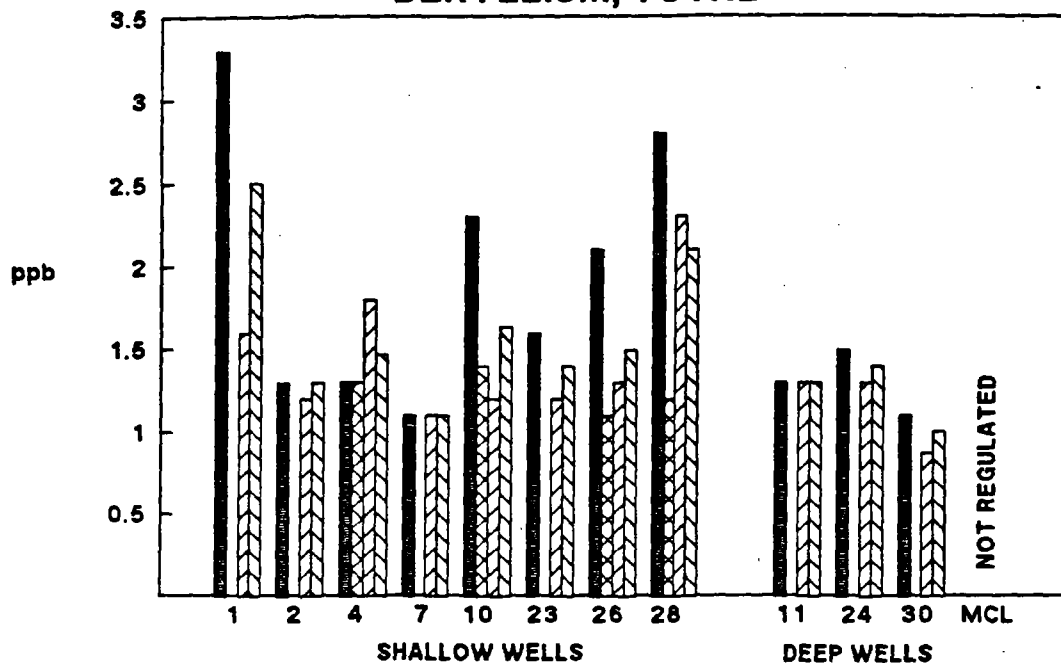
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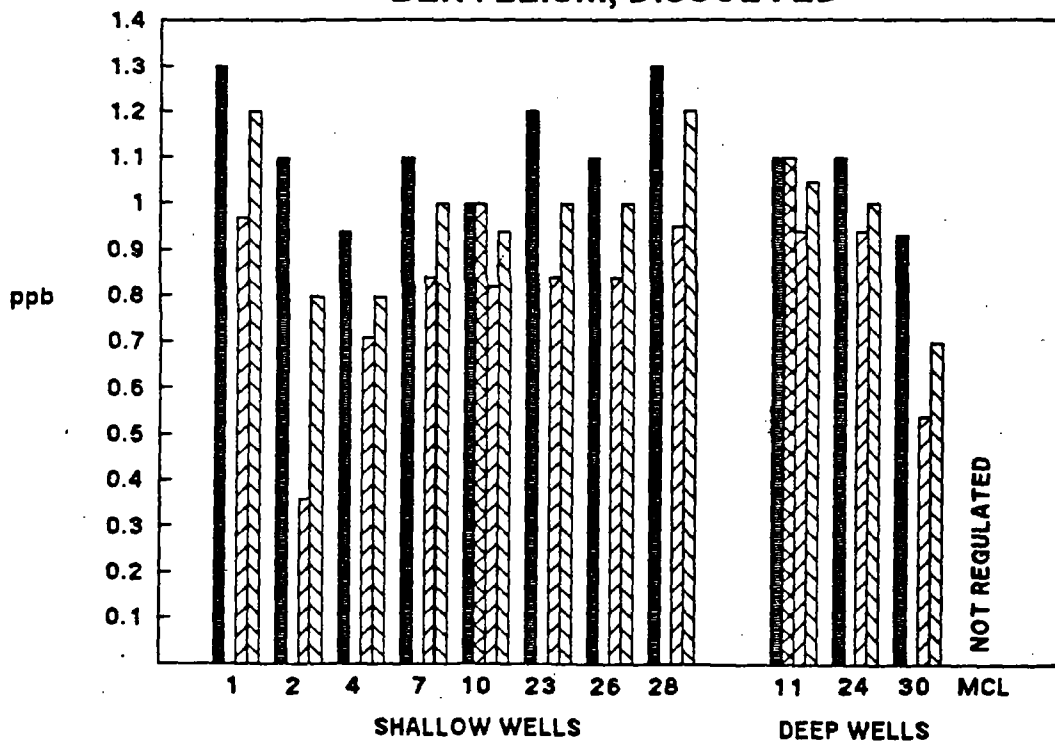
A-11

WASTE DISPOSAL, INCORPORATED

BERYLLIUM, TOTAL



BERYLLIUM, DISSOLVED



FEB 92

MAY 92

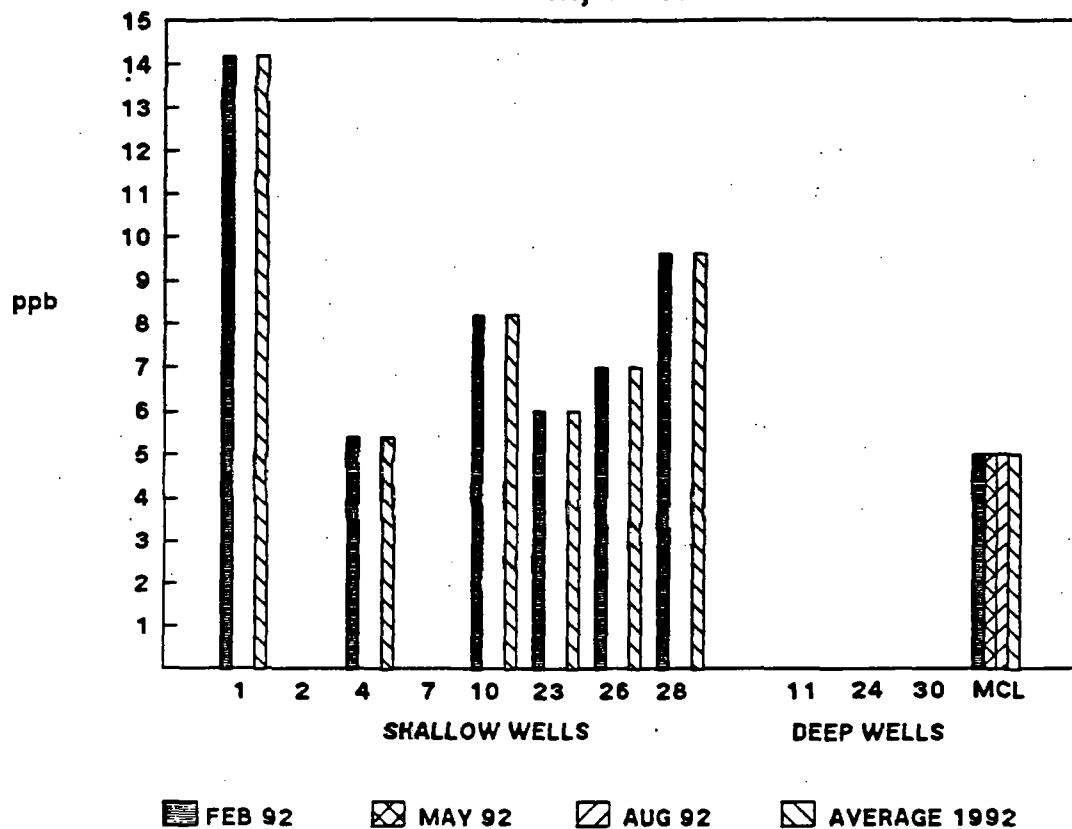
AUG 92

AVERAGE 1992

A-5

WASTE DISPOSAL, INCORPORATED

CADMIUM, TOTAL

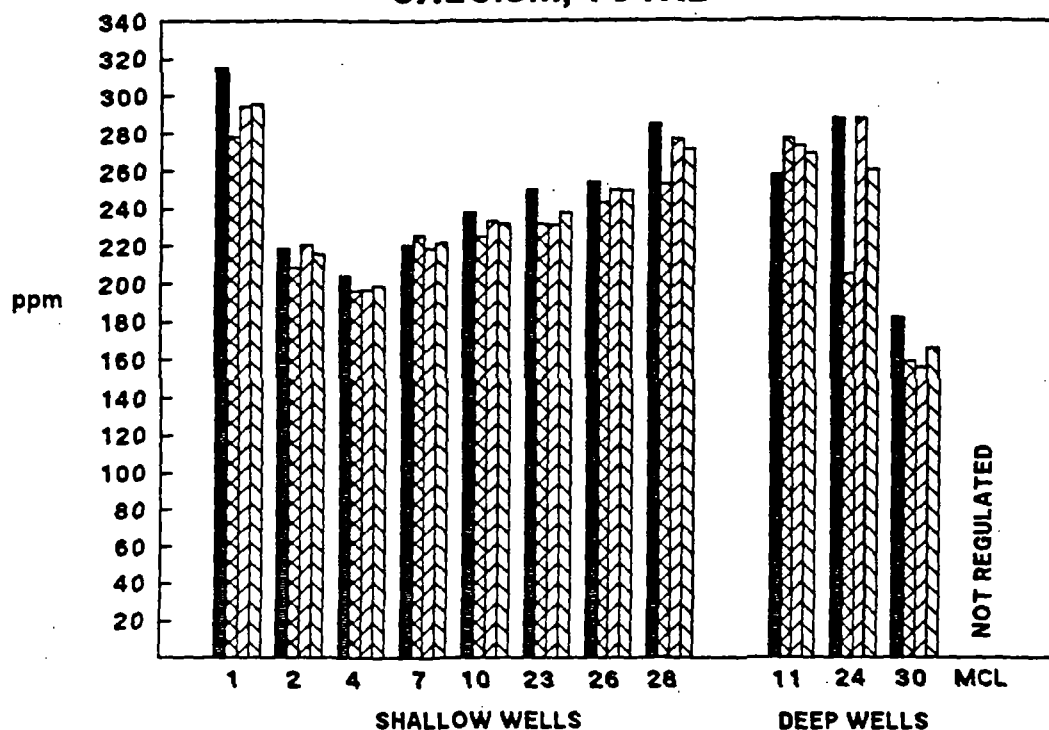


DISSOLVED CADMIUM

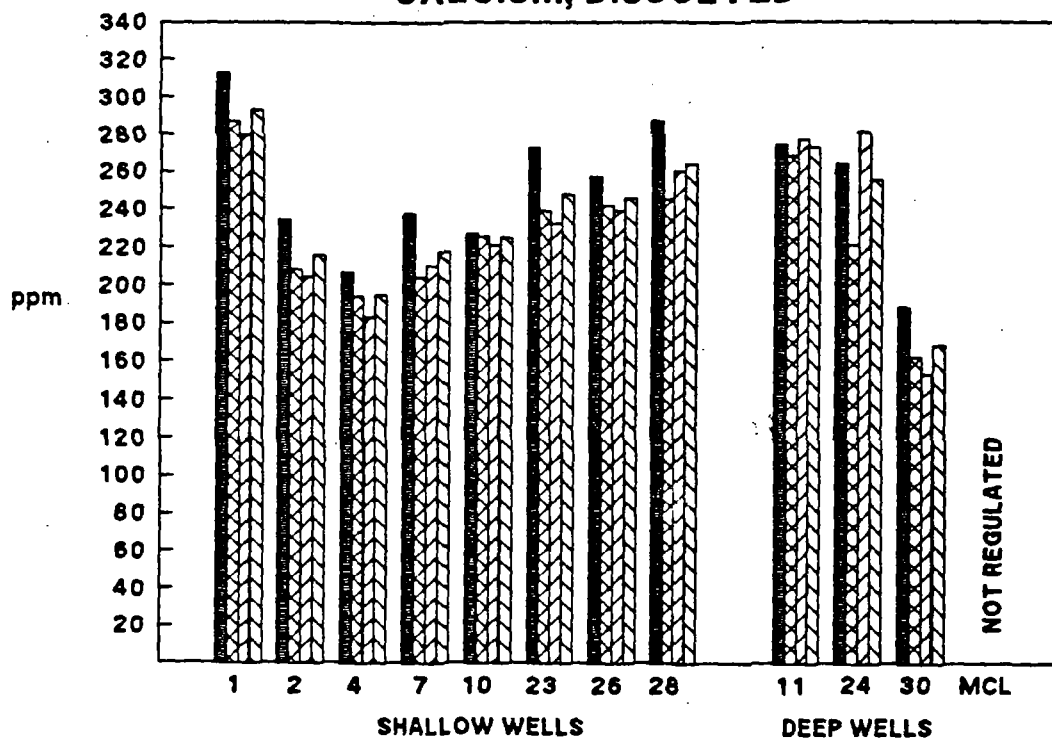
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WASTE DISPOSAL, INCORPORATED

CALCIUM, TOTAL



CALCIUM, DISSOLVED



FEB 92

MAY 92

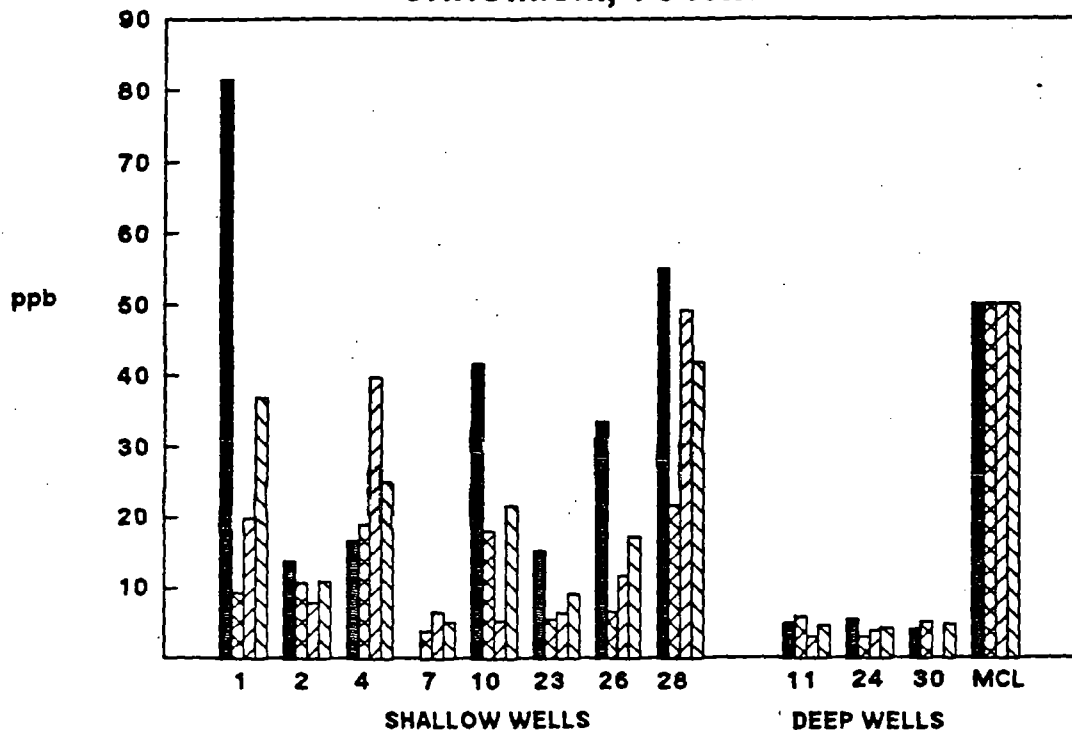
AUG 92

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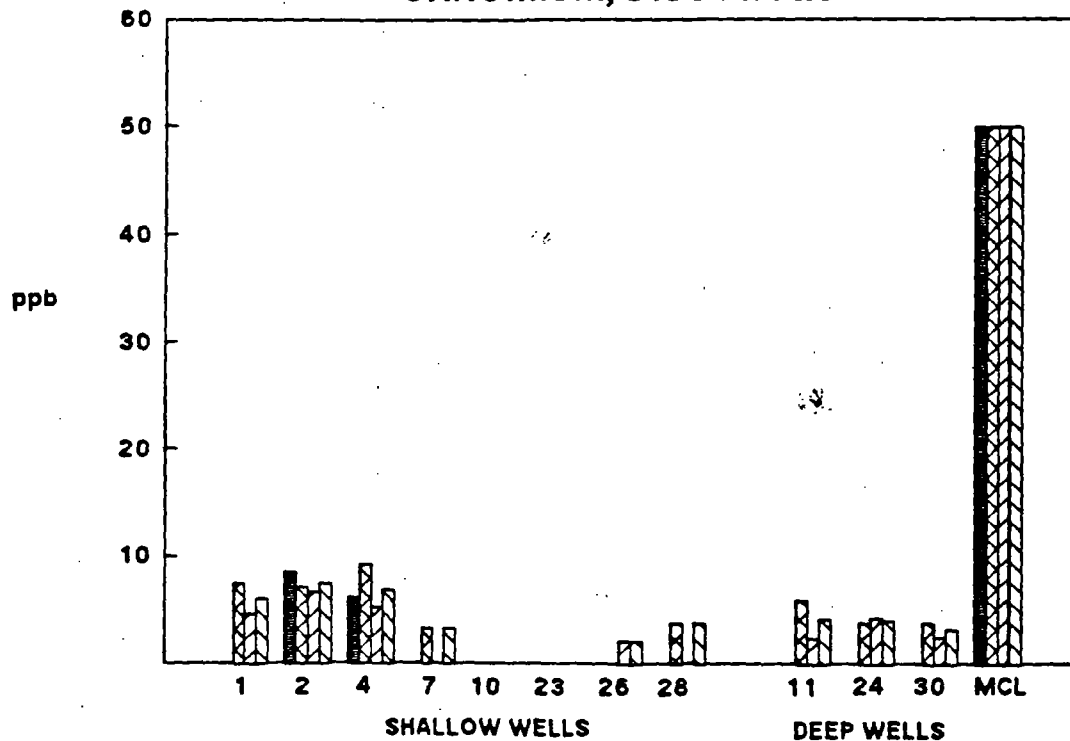
17-2

WASTE DISPOSAL, INCORPORATED

CHROMIUM, TOTAL



CHROMIUM, DISSOLVED



FEB 92

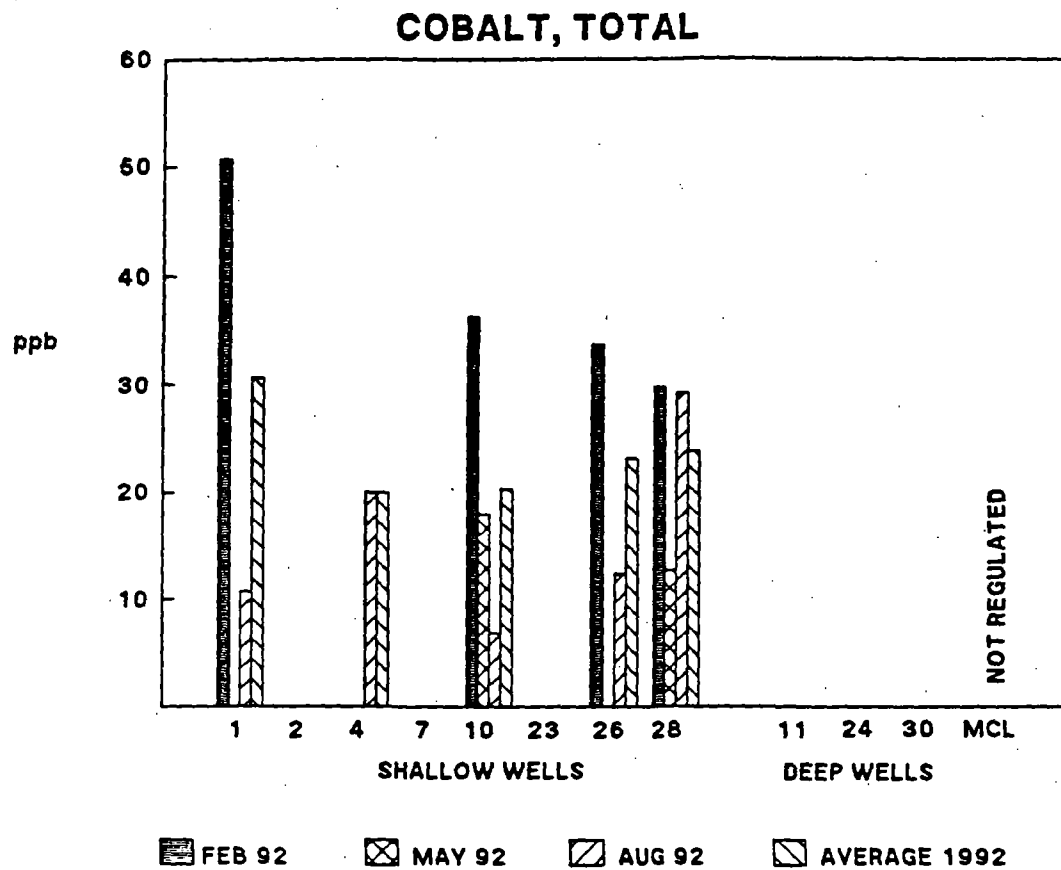
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AUG 92

AVERAGE 1992

A-8

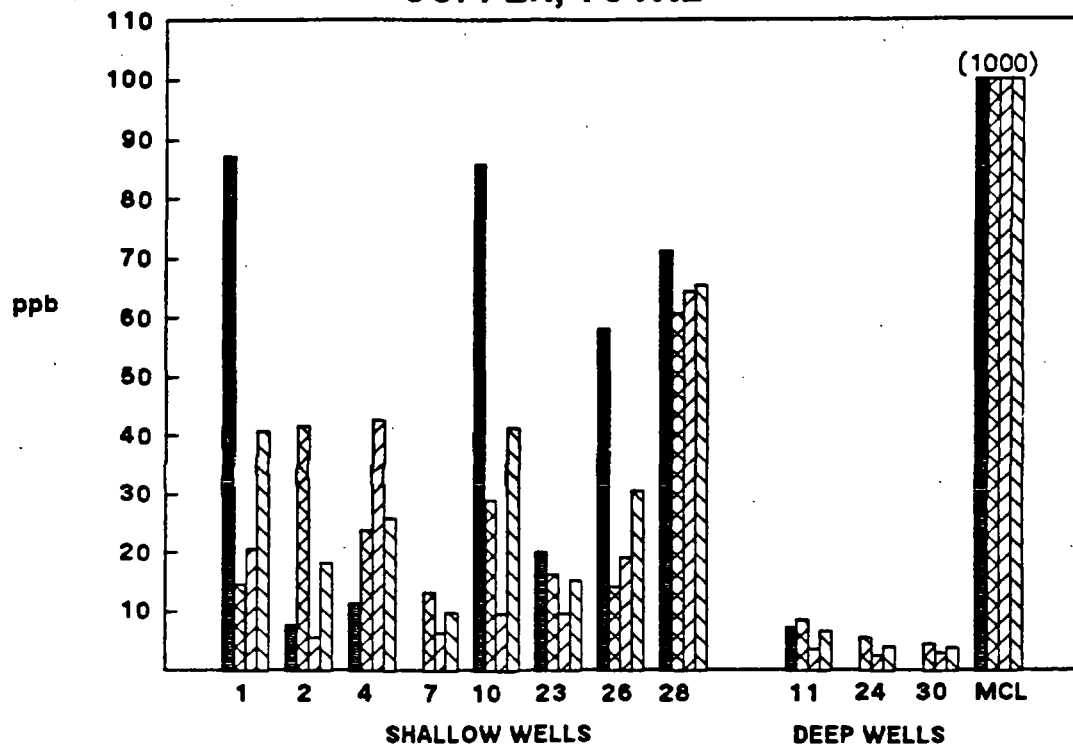
WASTE DISPOSAL, INCORPORATED



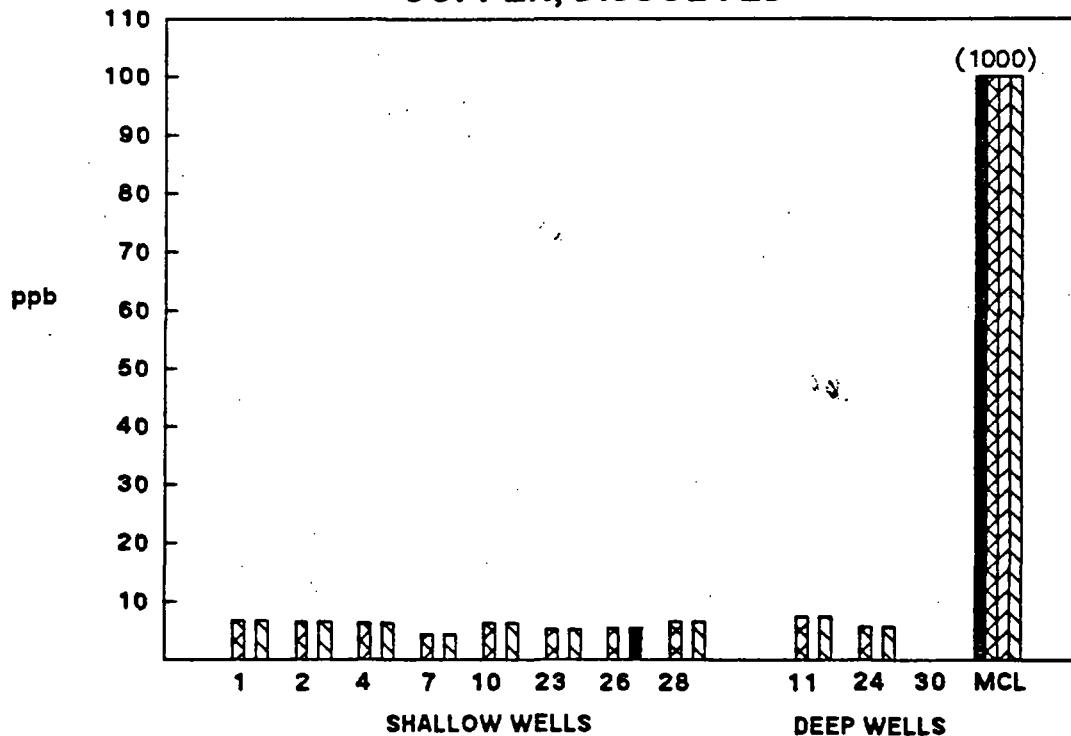
**DISSOLVED COBALT
NOT DETECTED**

WASTE DISPOSAL, INCORPORATED

COPPER, TOTAL



COPPER, DISSOLVED



FEB 92

MAY 92

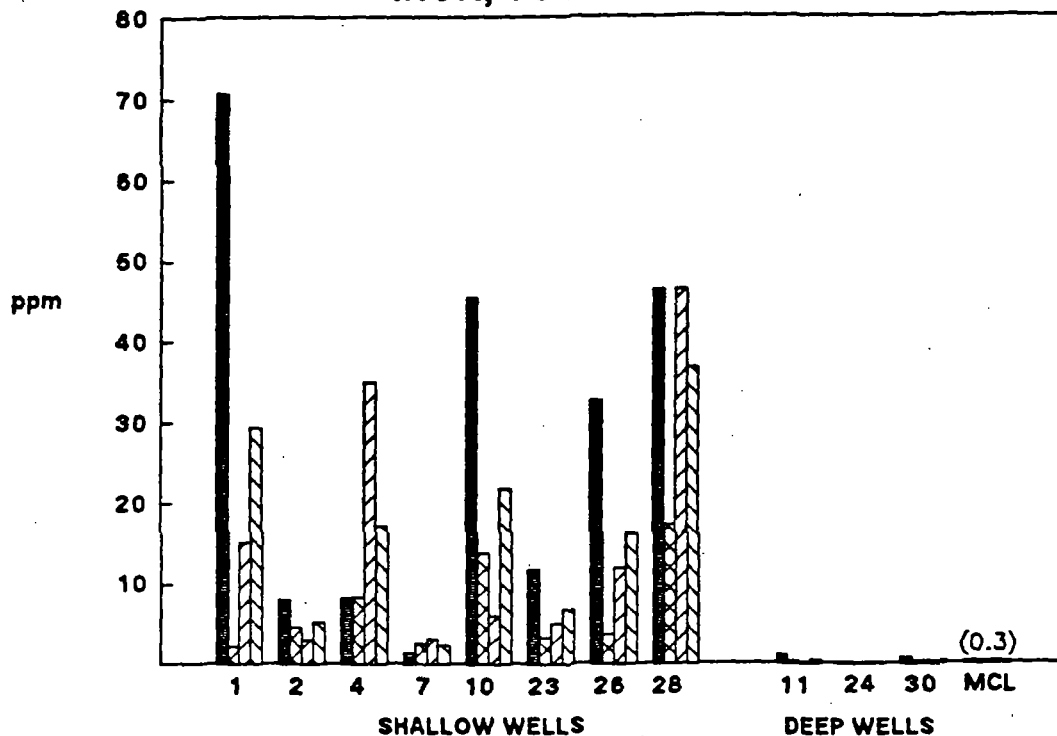
AUG 92

AVERAGE 1992

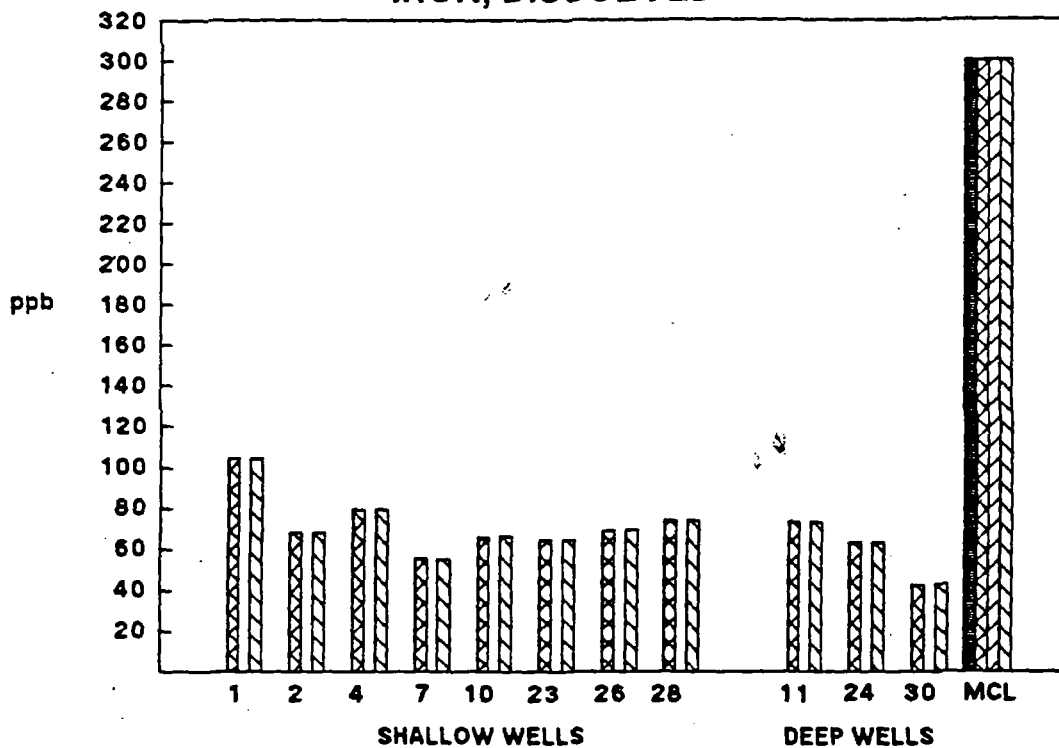
8.10

WASTE DISPOSAL, INCORPORATED

IRON, TOTAL



IRON, DISSOLVED



FEB 92

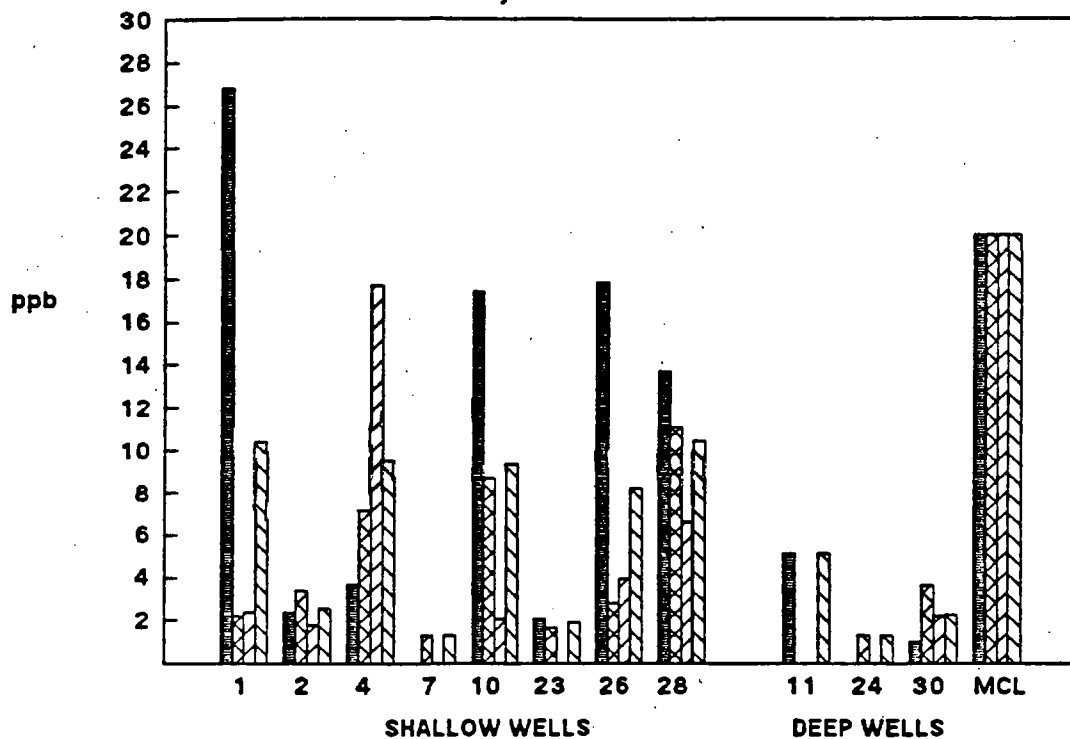
MAY 92

AUG 92

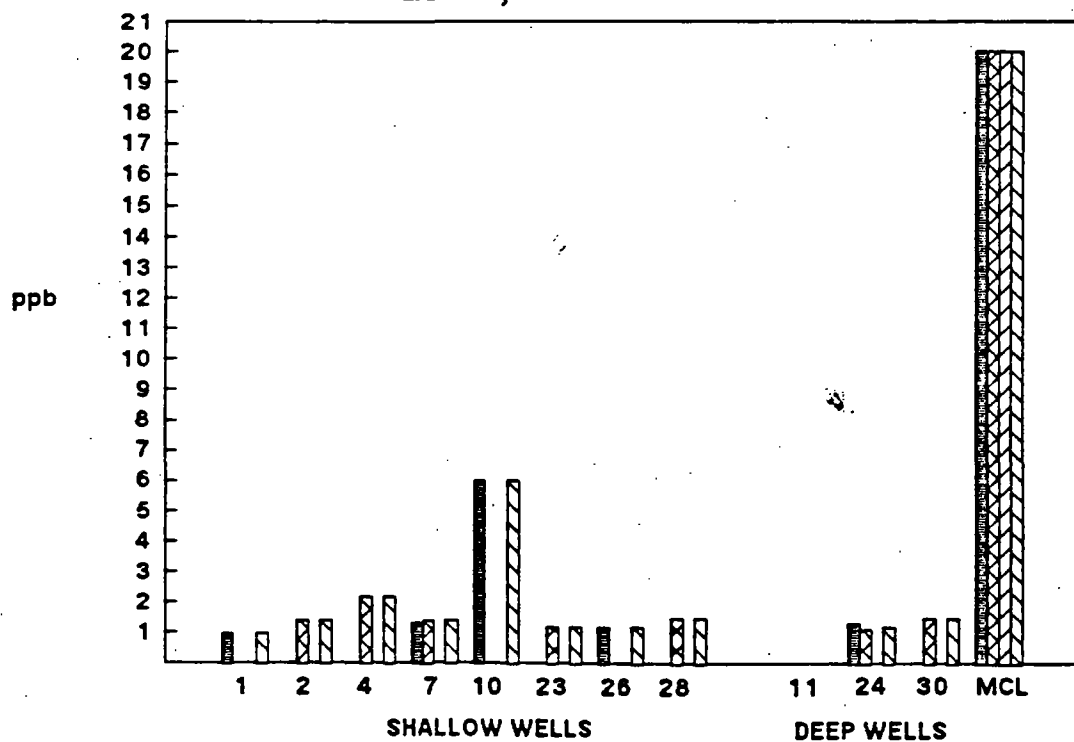
AVERAGE 1992

WASTE DISPOSAL, INCORPORATED

LEAD, TOTAL



LEAD, DISSOLVED



FEB 92

MAY 92

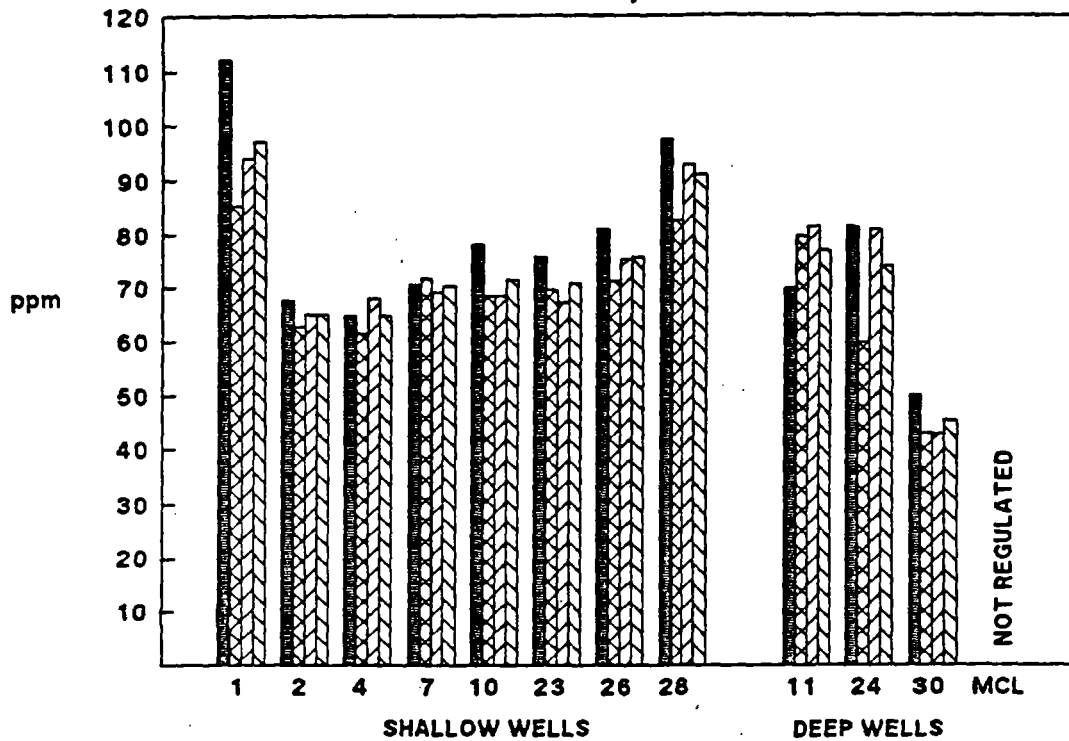
AUG 92

AVERAGE 1992

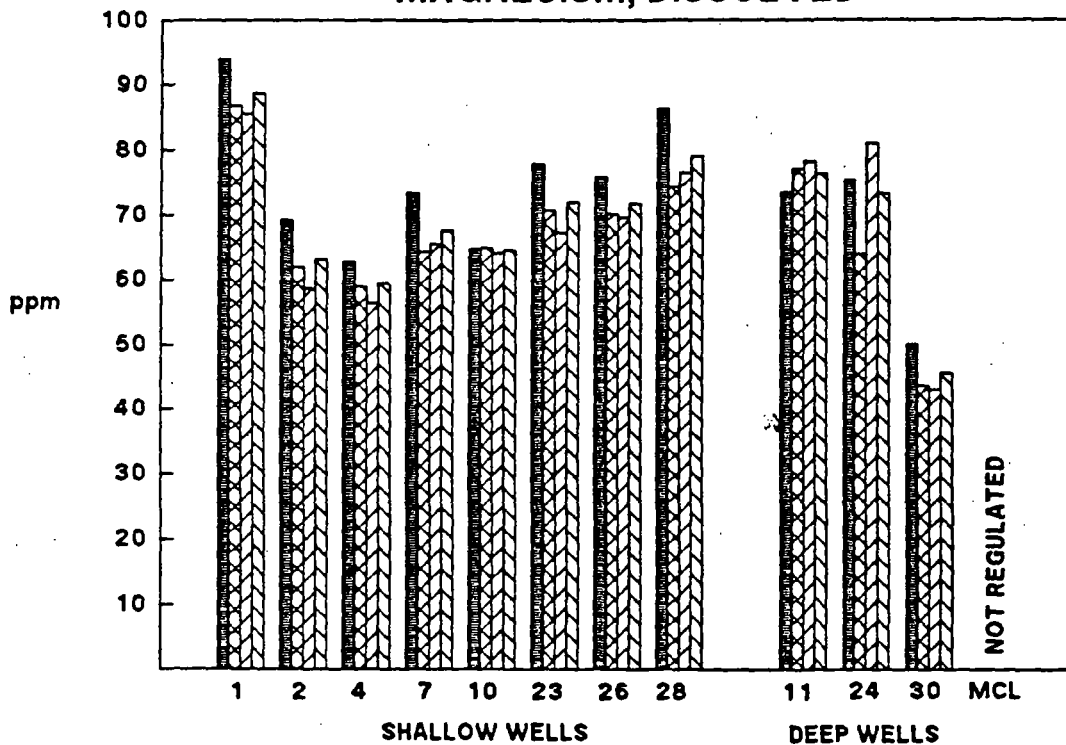
A-12

WASTE DISPOSAL, INCORPORATED

MAGNESIUM, TOTAL



MAGNESIUM, DISSOLVED



FEB 92

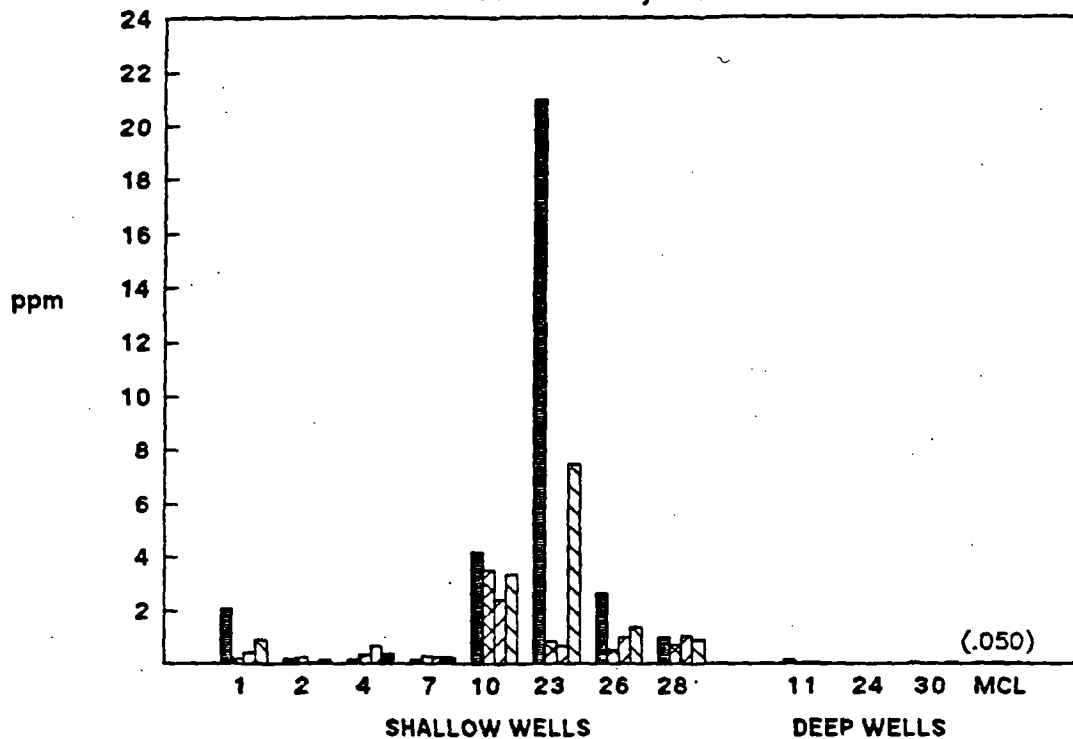
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AUG 92

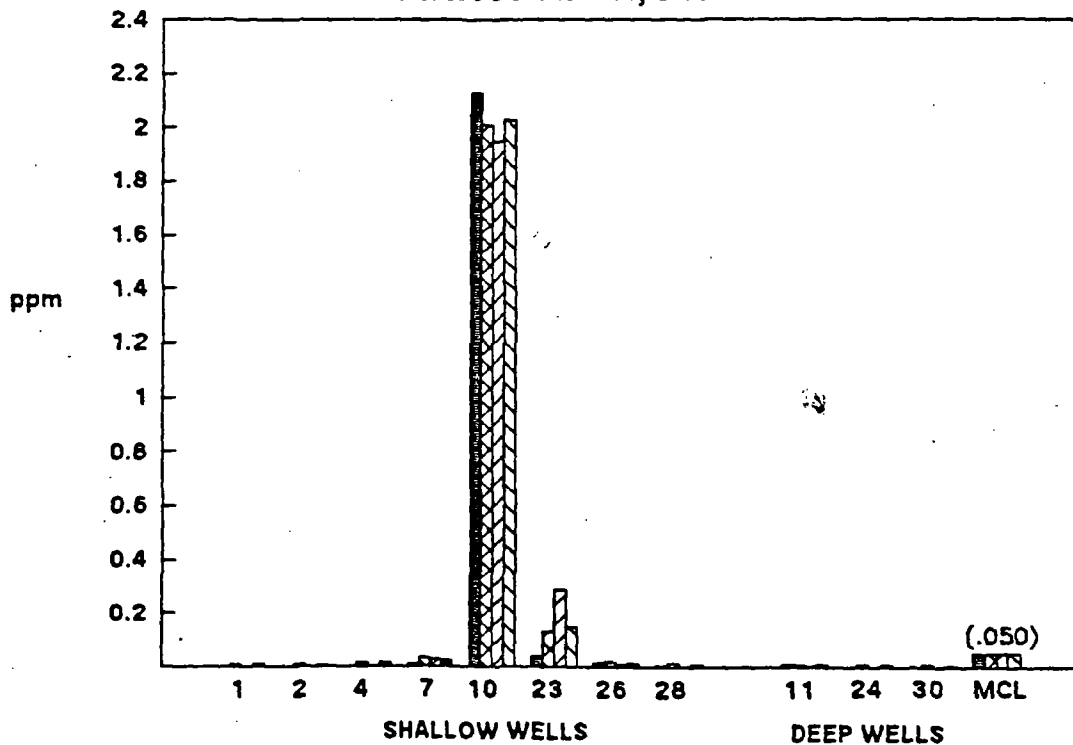
AVERAGE 1992

WASTE DISPOSAL, INCORPORATED

MANGANESE, TOTAL



MANGANESE, DISSOLVED



FEB 92

MAY 92

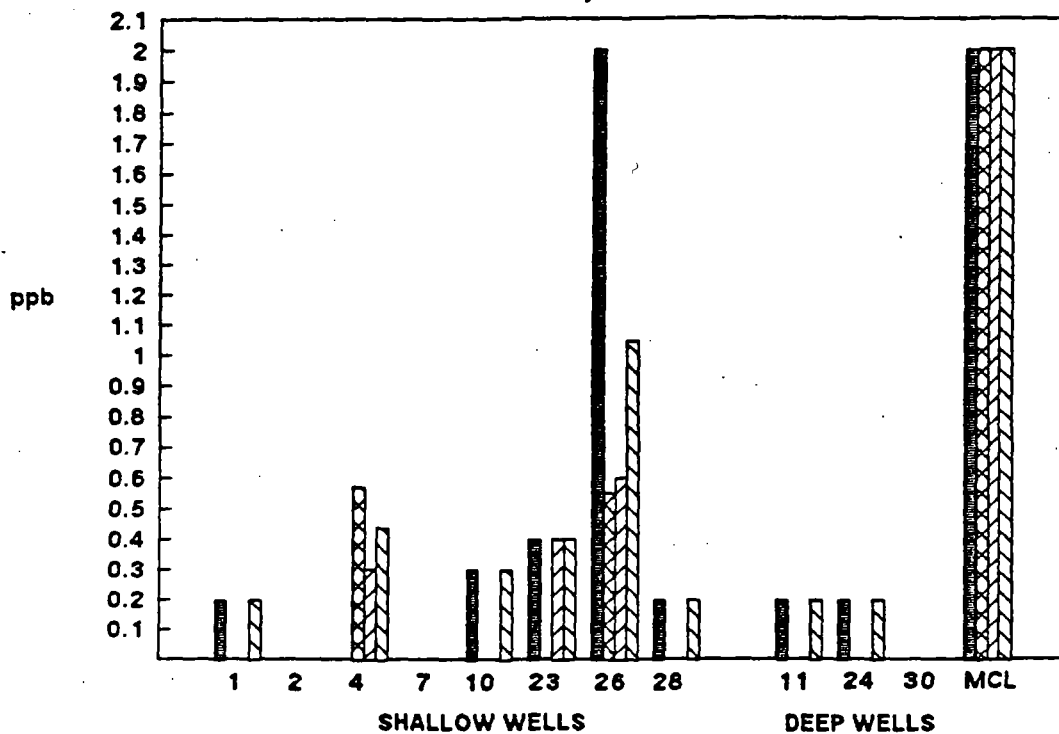
AUG 92

AVERAGE 1992

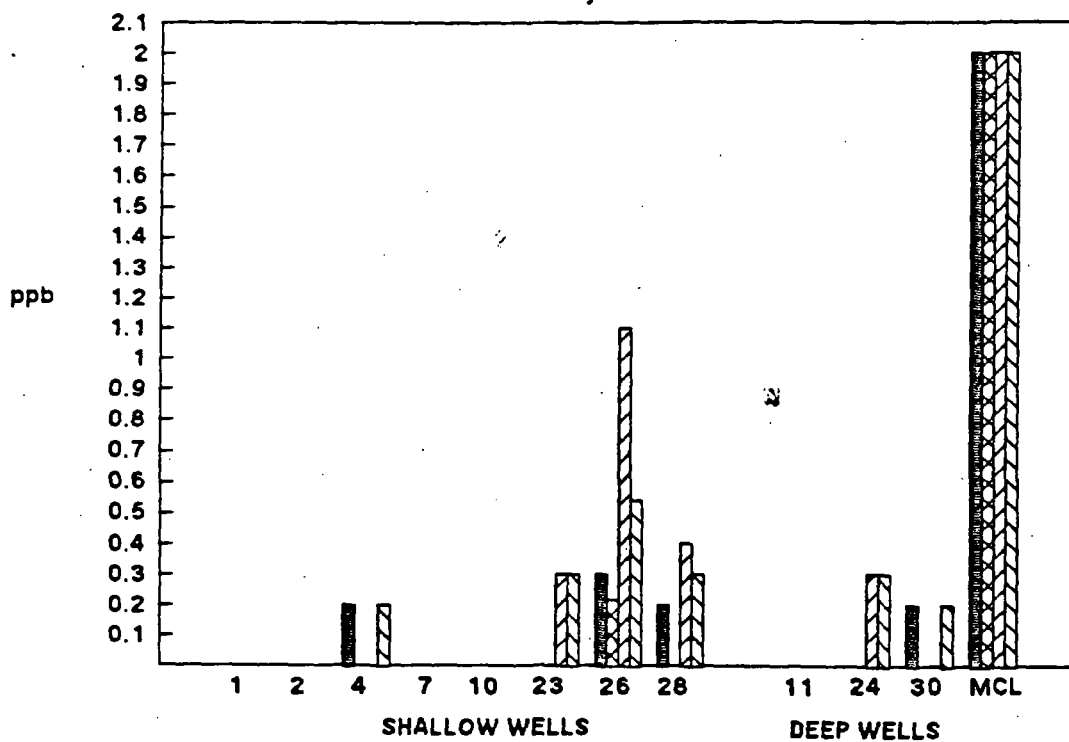
H-14

WASTE DISPOSAL, INCORPORATED

MERCURY, TOTAL



MERCURY, DISSOLVED



FEB 92

MAY 92

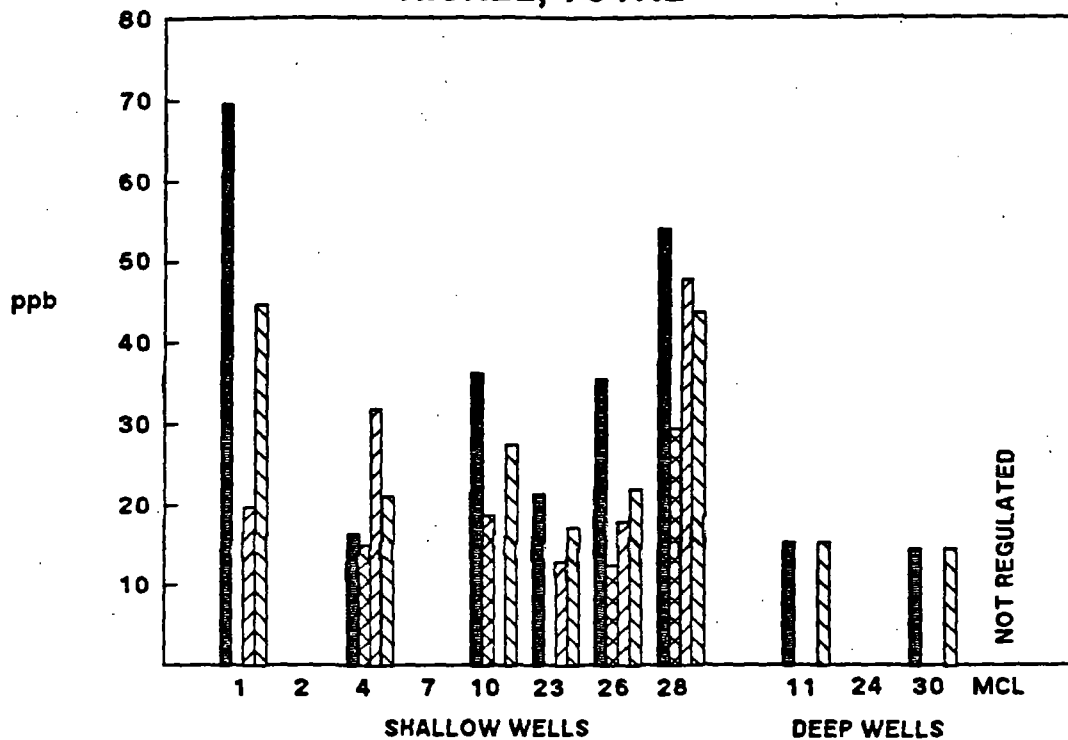
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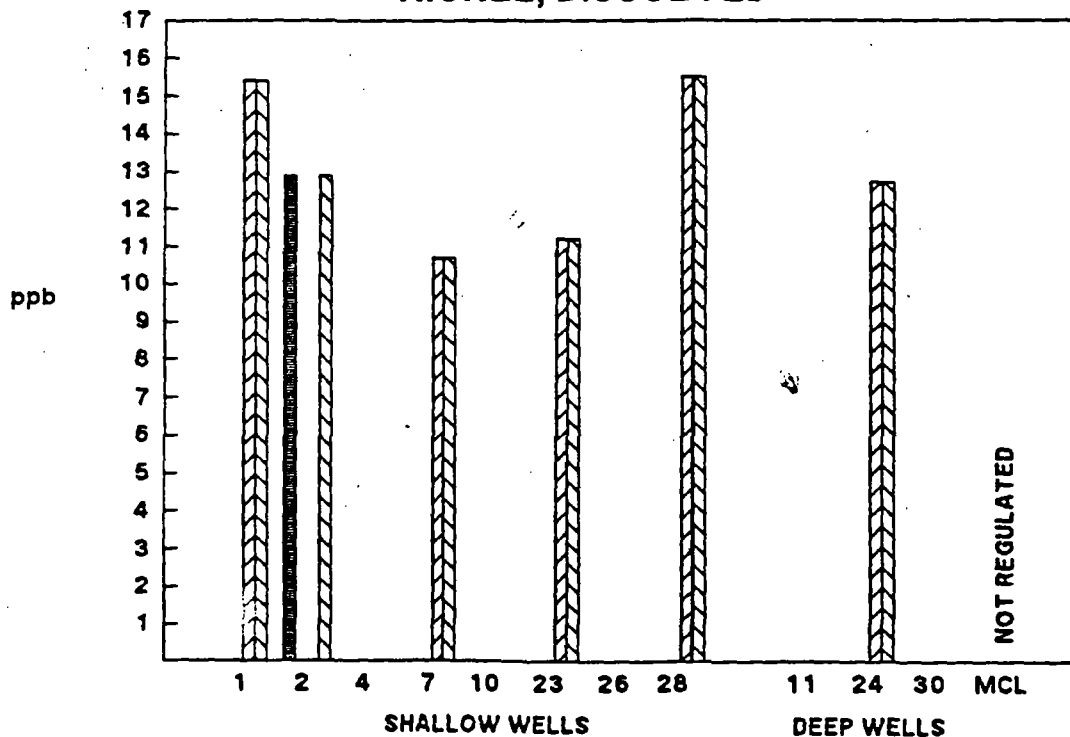
A-15

WASTE DISPOSAL, INCORPORATED

NICKEL, TOTAL



NICKEL, DISSOLVED



FEB 92

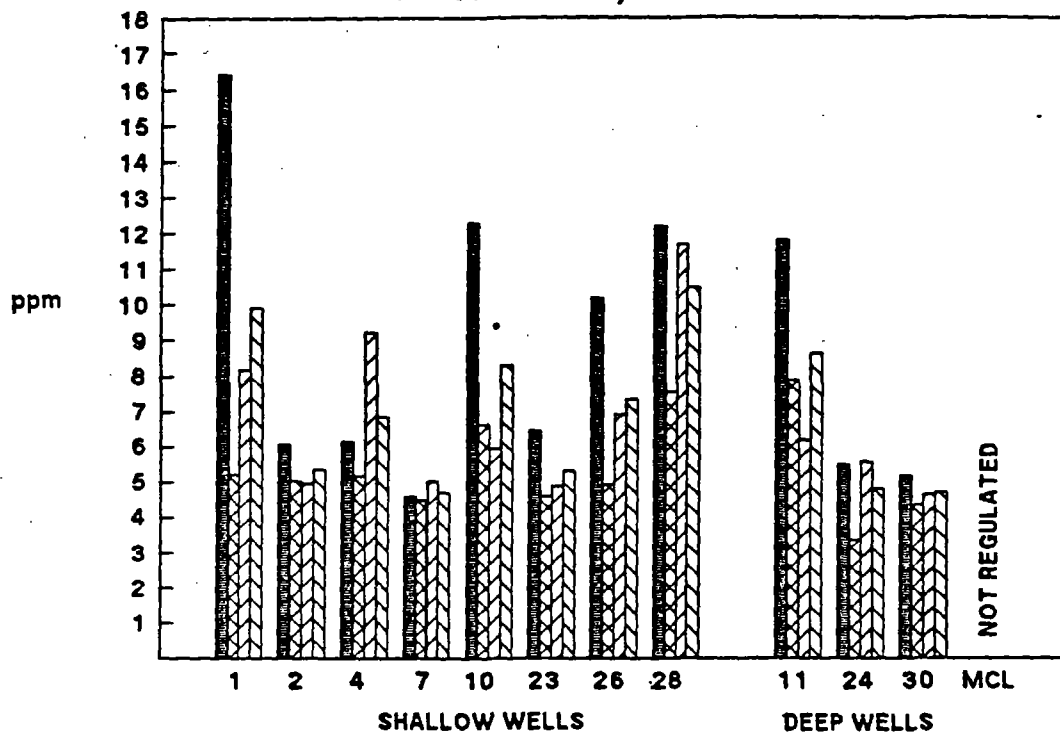
MAY 92

AUG 92

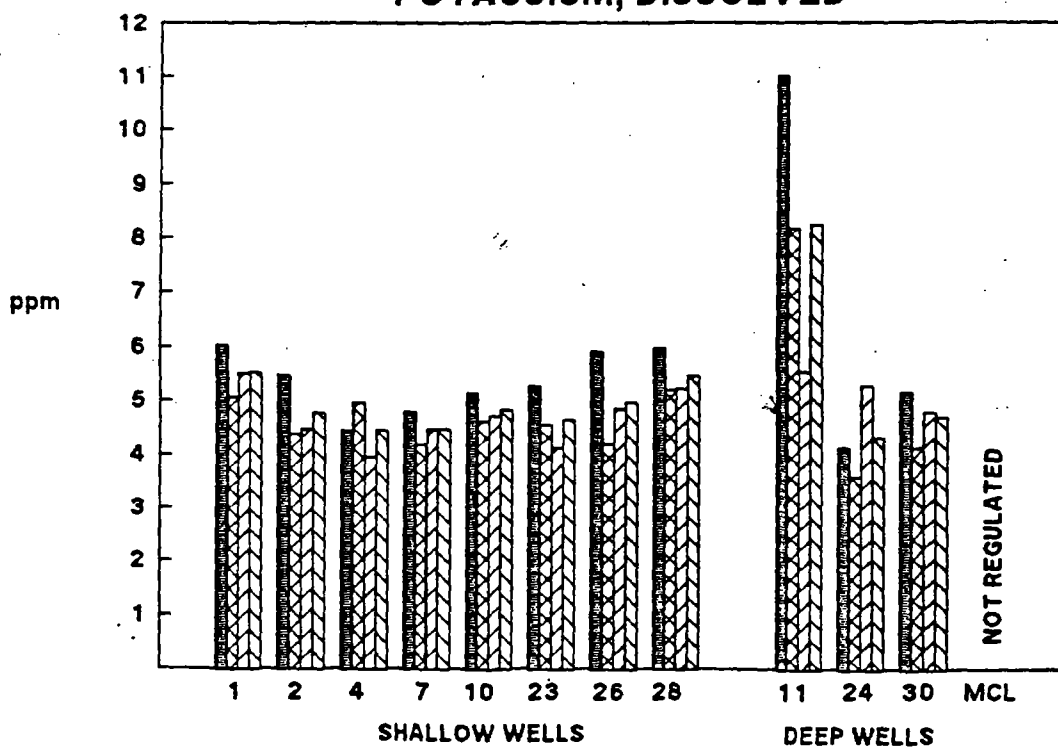
AVERAGE 1992

WASTE DISPOSAL, INCORPORATED

POTASSIUM, TOTAL



POTASSIUM, DISSOLVED



FEB 92

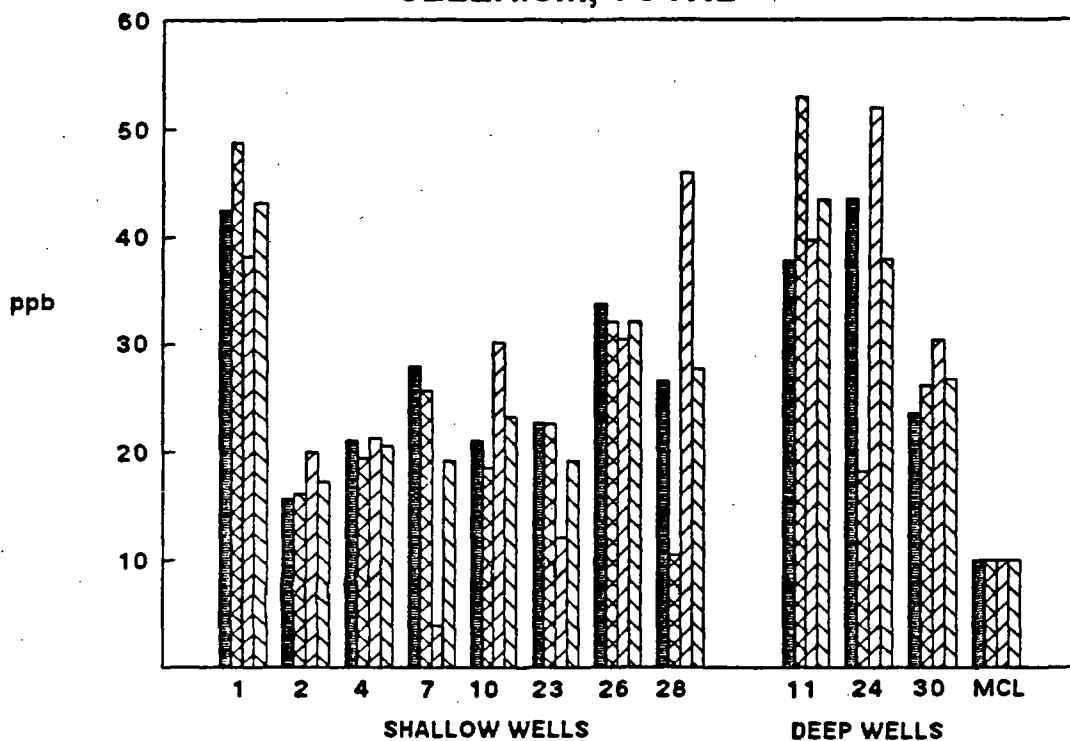
MAY 92

AUG 92

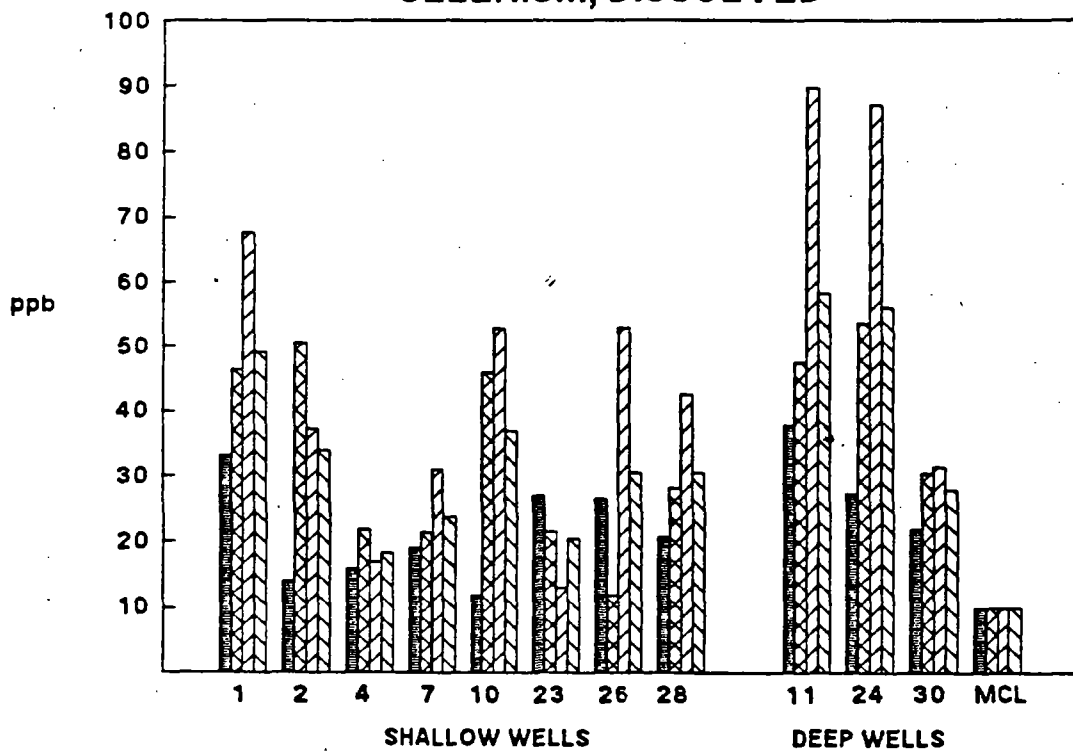
AVERAGE 1992

WASTE DISPOSAL, INCORPORATED

SELENIUM, TOTAL



SELENIUM, DISSOLVED



FEB 92

MAY 92

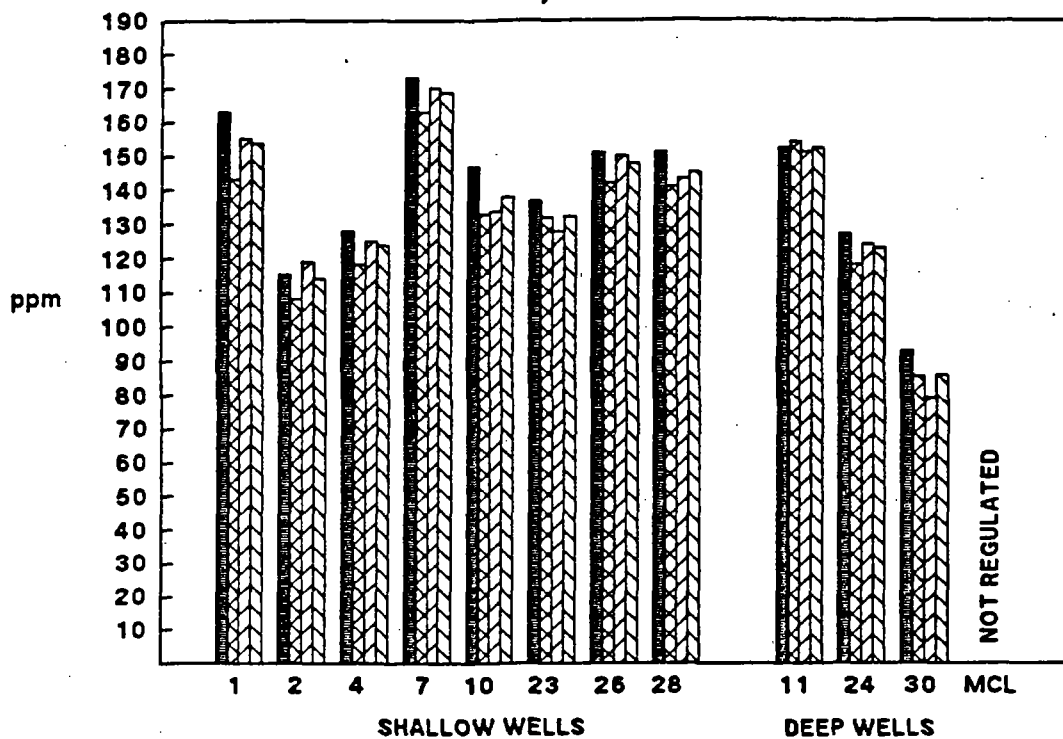
AUG 92

AVERAGE 1992

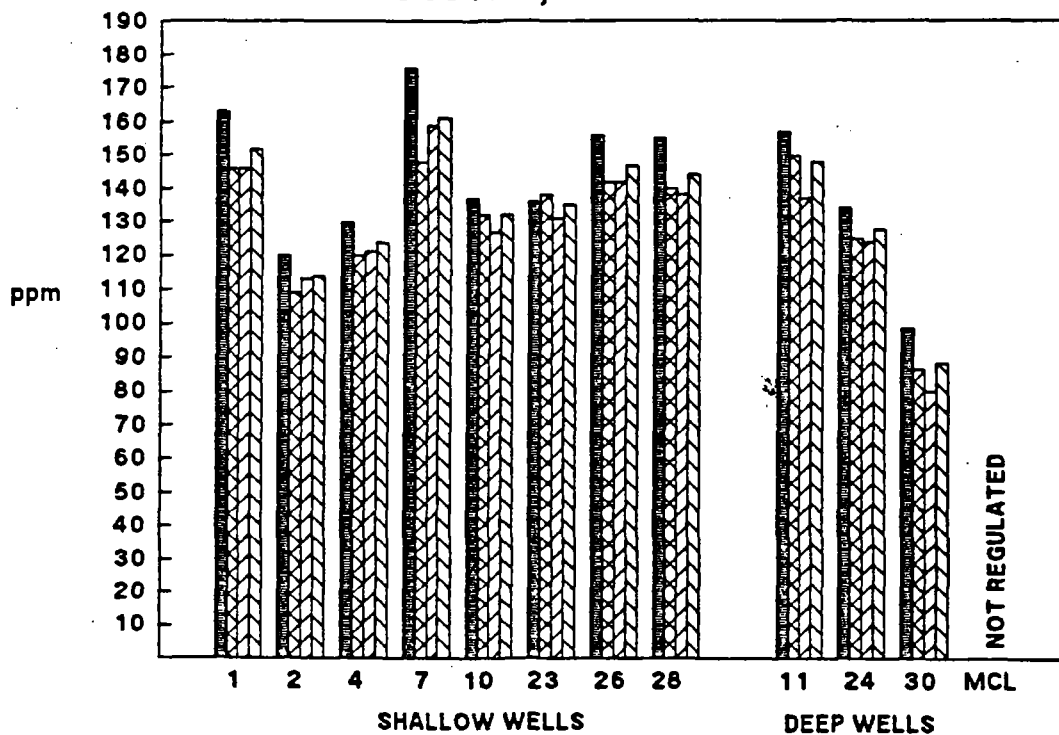
4-13

WASTE DISPOSAL, INCORPORATED

SODIUM, TOTAL



SODIUM, DISSOLVED



FEB 92

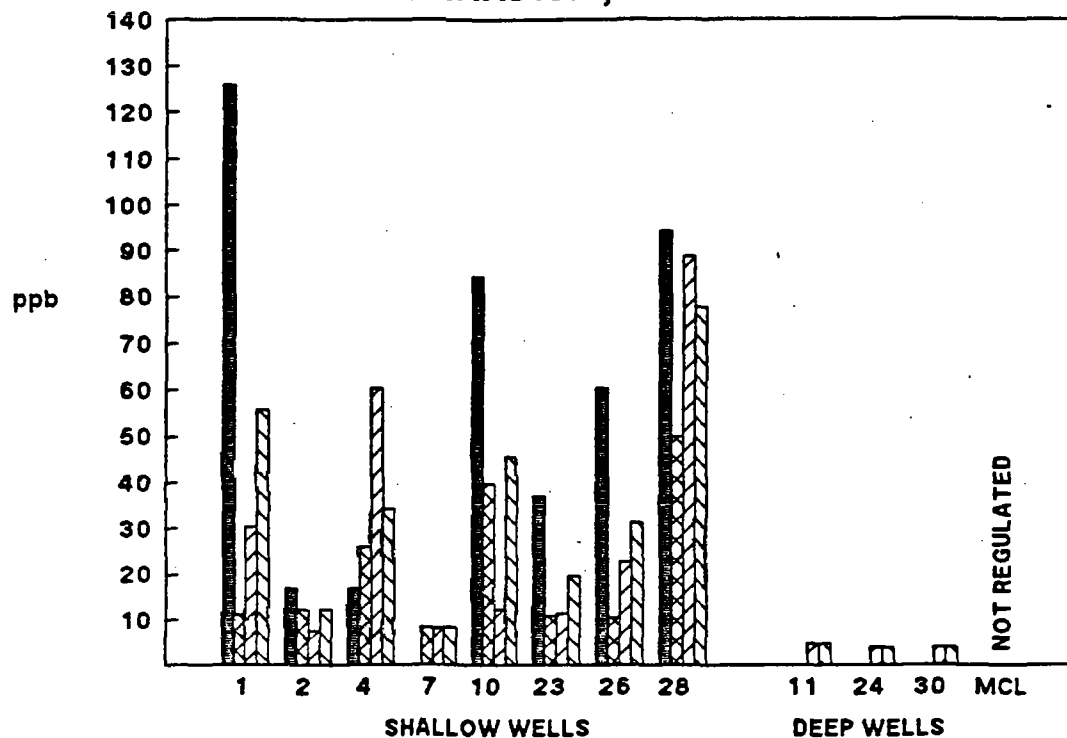
MAY 92

AUG 92

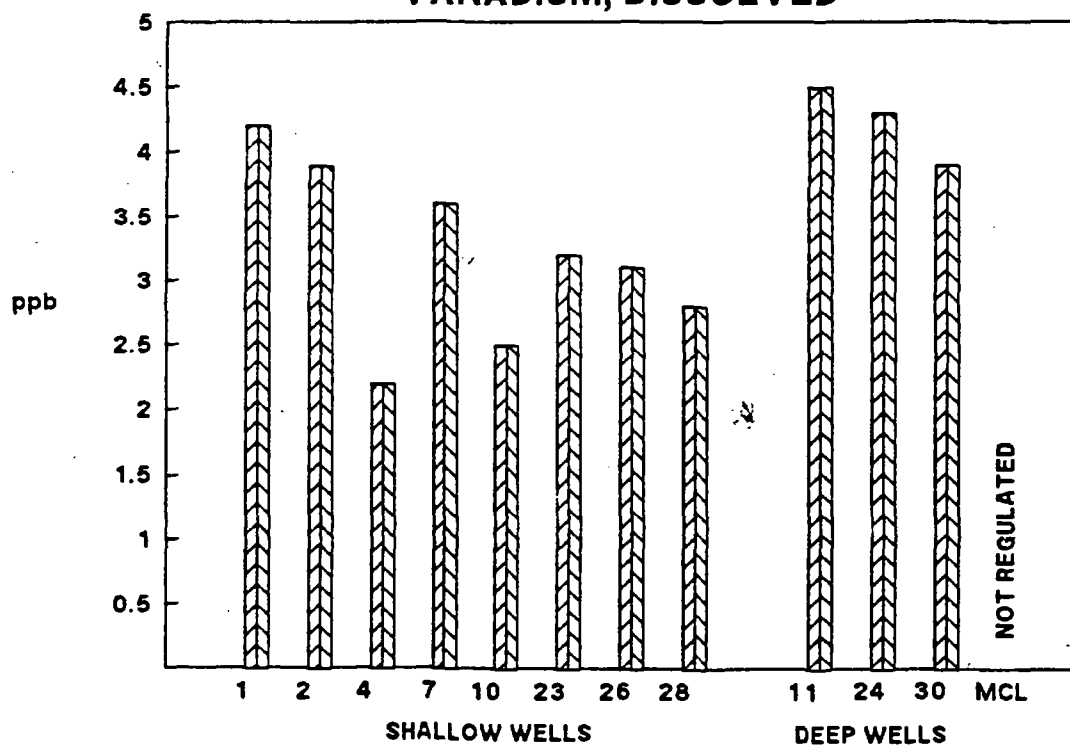
AVERAGE 1992

WASTE DISPOSAL, INCORPORATED

VANADIUM, TOTAL



VANADIUM, DISSOLVED



FEB 92

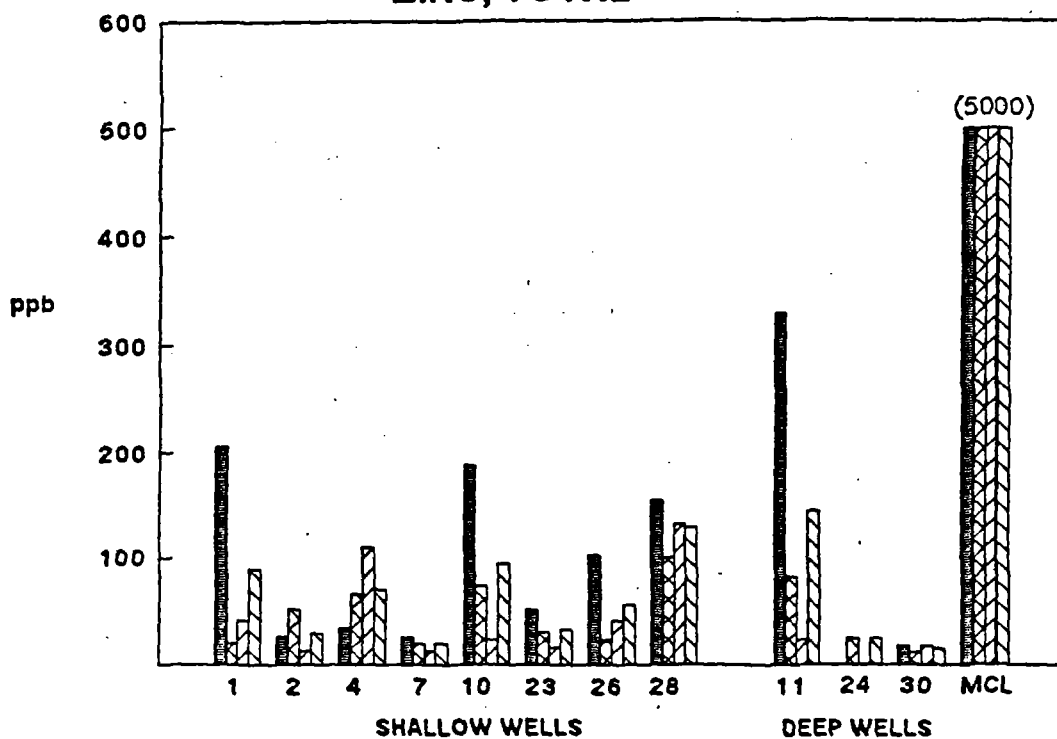
MAY 92

AUG 92

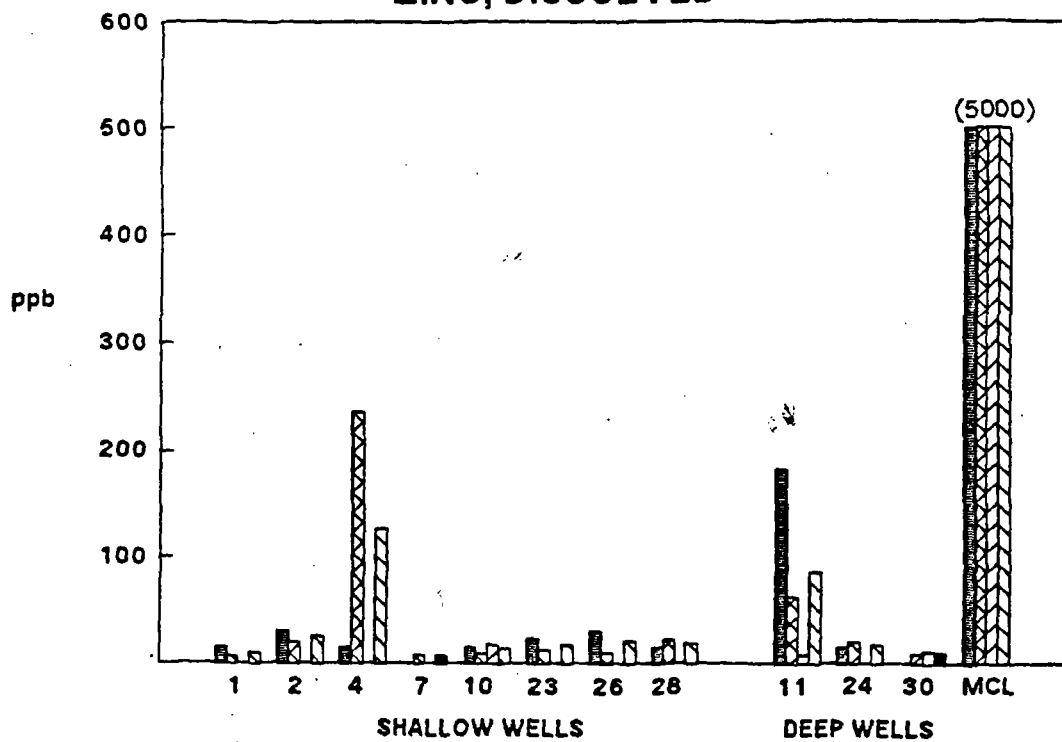
AVERAGE 1992

WASTE DISPOSAL, INCORPORATED

ZINC, TOTAL



ZINC, DISSOLVED



FEB 92

MAY 92

AUG 92

AVERAGE 1992

A-21

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TABLE 4-13 (Continued)

PARAMETER	DEPTH (IN FT)	SAMPLE NO.	CONCEN- TRATION	DETECT	QA	VALI- DATED	STLC LIMIT	HAZARDOUS	
								TCLC LIMIT	WASTE LIMIT
Acetone	10	SB-078-004	36.00	B		.F.	---	---	---
Acetone	10	SB-079-004	49.00	B		.F.	---	---	---
Acetone	15	SB-070-004	7.00	BJ		.F.	---	---	---
Acetone	15	SB-070-004	7.00	BJ		.F.	---	---	---
Acetone	20	SB-061-007	8.00	BJ		.F.	---	---	---
Acetone	20	SB-070-007	29.00			.F.	---	---	---
Acetone	20	SB-071-004	34.00			.F.	---	---	---
Acetone	20	SB-079-007	79.00	B		.F.	---	---	---
Acetone	25	SB-070-010	16.00	B		.F.	---	---	---
Acetone	25	SB-070-010	16.00	B		.F.	---	---	---
Acetone	30	SB-070-013	36.00			.F.	---	---	---
Acetone	35	SB-061-010	73.00			.F.	---	---	---
Acetone	35	SB-070-016	230.00	B		.F.	---	---	---
Acetone	35	SB-071-007	300.00	B		.F.	---	---	---
Acetone	35	SB-078-007	63.00			.F.	---	---	---
Acetone	35	SB-079-010	18.00	B		.F.	---	---	---
Benzene	35	SB-070-016	1.00	J		.F.	---	---	---
Benzene	35	SB-079-010	6.00			.F.	---	---	---
Chloroform	0	SB-079-001	2.00	BJ		.F.	---	---	---
Chloroform	10	SB-078-004	2.00	BJ		.F.	---	---	---
Chloroform	10	SB-079-004	2.00	BJ		.F.	---	---	---
Chloroform	20	SB-079-007	3.00	BJ		.F.	---	---	---
Ethylbenzene	0	SB-061-001	5.00	J		.F.	---	---	---
Ethylbenzene	35	SB-071-007	10.00	J		.F.	---	---	---
Ethylbenzene	35	SB-079-010	11.00			.F.	---	---	---
Methylene Chloride	0	SB-061-001	12.00	B		.F.	---	---	---
Methylene Chloride	0	SB-078-001	33.00	B		.F.	---	---	---
Methylene Chloride	0	SB-078-001	4.00	J		.F.	---	---	---
Methylene Chloride	0	SB-079-001	15.00	B		.F.	---	---	---
Methylene Chloride	5	SB-070-001	2.00	BJ		.F.	---	---	---
Methylene Chloride	5	SB-070-001	2.00	BJ		.F.	---	---	---
Methylene Chloride	10	SB-061-004	10.00	B		.F.	---	---	---
Methylene Chloride	10	SB-071-001	10.00	B		.F.	---	---	---
Methylene Chloride	10	SB-078-004	26.00	B		.F.	---	---	---
Methylene Chloride	10	SB-079-004	17.00	B		.F.	---	---	---
Methylene Chloride	15	SB-070-004	2.00	BJ		.F.	---	---	---
Methylene Chloride	15	SB-070-004	2.00	BJ		.F.	---	---	---
Methylene Chloride	20	SB-061-007	6.00	B		.F.	---	---	---
Methylene Chloride	20	SB-070-007	7.00	J		.F.	---	---	---
Methylene Chloride	20	SB-071-004	8.00	J		.F.	---	---	---
Methylene Chloride	20	SB-079-007	17.00	B		.F.	---	---	---
Methylene Chloride	25	SB-070-010	1.00	BJ		.F.	---	---	---
Methylene Chloride	25	SB-070-010	1.00	BJ		.F.	---	---	---
Methylene Chloride	30	SB-070-013	8.00	J		.F.	---	---	---
Methylene Chloride	35	SB-061-010	19.00	B		.F.	---	---	---
Methylene Chloride	35	SB-070-016	170.00	B		.F.	---	---	---
Methylene Chloride	35	SB-071-007	140.00	B		.F.	---	---	---
Methylene Chloride	35	SB-078-007	42.00	B		.F.	---	---	---